SUPPORT DOCUMENT

(File name bcw sup1198rev)

for the Air Operating Permit issued to

Boise Cascade Corporation
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Highway 12
Wallula, Washington

State of Washington
DEPARTMENT OF ECOLOGY
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INTRODUCTION

This Operating Permit Support Document fulfills the operating permit rule "Statement of Basis" requirement and explains particular portions of the air operating permit for the Boise Cascade Wallula Mill.

This document is not part of the operating permit for the Boise Cascade Wallula Mill. Nothing in this document is enforceable against the permittee, unless otherwise made enforceable by permit or order.

STATEMENT OF BASIS

When the Department of Ecology issues a draft operating permit, it is required to provide a statement that sets forth the legal and factual basis for the draft permit conditions, including references to the applicable statutory or regulatory provisions. [WAC 173-401-700(8).]

I. Process Description

Chip Handling

The chip handling area includes unloading, chip storage piles transfer, and screening of wood chips, as well as ancillary support activities. Here, incoming chips and sawdust are allocated to the different pulping processes. Trucks and rail cars unload wood chips and sawdust into chip dumpers or portable dumper where they are conveyed to the appropriate chip and sawdust piles. These piles are designated as the Kamyr chip pile, the M&D sawdust pile, the NSSC chip pile and the M&D cottonwood pile. The material from these piles is then conveyed to the digesters for screening and pulping. Waste wood from the chip screening operation and waste wood from other sources are stored on the hog fuel pile from which the waste wood is burned in a hog fuel boiler to generate steam for the mill processes.

Neutral Sulfite Semi-Chemical (NSSC) Pulping Line

The NSSC system produces pulp that is used to manufacture corrugated medium or other unbleached paper products. The NSSC system is composed of the pink liquor production, NSSC pulp production, and the No. 2 Paper Machine.

In the pink liquor production process, sulfur is oxidized using ambient air in a sulfur burner to produce sulfur dioxide. The sulfur dioxide is cooled in a cooling tower and then reacted with a caustic solution to produce pink liquor (sodium sulfite) in the absorption tower. The pink liquor is stored for use in the NSSC digester.

In the NSSC pulping process, chips from the NSSC tunnel are washed and steamed before entering the NSSC digester. In the NSSC impregnation vessel, chips are impregnated with a

combination of pink and spent NSSC brown liquor. Following the NSSC impregnation vessel, the chips and liquors are cooked with steam at elevated temperature and pressure to partially remove lignin from the chips in the NSSC digester. The pulp is then pressed and washed to remove the brown liquor. The brown liquor is then pumped to the recovery process where it is mixed with weak black liquor and combusted in the recovery furnaces. The clean pulp is processed by the No. 1 and No. 2 Raffinators, which separate the fibers. The pulp is then stored in high density storage for use in the production of corrugated medium or other unbleached products on the No. 2 Paper Machine.

Kraft Pulping, Washing, and Bleaching

The pulping and washing system produces feedstock for the No. 1 and No. 3 Paper Machines. The KAMYR and M&D process lines produce and wash the pulp using similar methods.

The wood chips are conveyed from their respective piles to the Kamyr digester and No. 1 & 2 M&D digesters where white liquor from the causticizing process is absorbed by the chips under high steam pressure. The KAMYR Digester, and the No.1 and No. 2 M&D Digesters cook the chips and liquor and send the pulp to their respective washer lines. These washers extract the spent liquor and wash the pulp. The extracted liquor is sent to the weak black liquor storage tank for recovery. The washed pulp is screened and dewatered by deckers. After deckering, the pulp is sent to high density storage and eventually bleached in the bleach plant.

In the bleach plant, the pulp is bleached in stages using chlorine dioxide, hydrogen peroxide, oxygen, and chlorine or other chemicals in a series of towers and washers.

Chlorine Dioxide Generation

The chlorine dioxide generation process produces chlorine dioxide, a bleaching agent used in the pulp bleaching process. Sulfuric acid, methanol, and sodium chlorate solution react in the chlorine dioxide generator to create chlorine dioxide. The chlorine dioxide is cooled and stored for use at the bleach plant. The salt cake byproduct from the chlorine dioxide generator is filtered and fed to the weak Black Liquor Tank.

Power and Recovery

The power and recovery systems recover the chemicals used in the pulping process. The systems also produce energy in the form of steam for the mill. The steam production system is composed of two recovery furnaces, two power boilers, and a hog fuel boiler. The recovery furnaces burn a mixture of brown and black liquor to recover pulping chemicals, and produce steam as a by-product. Natural gas and fuel oil are fired in the recovery boilers as supplemental fuels. The power boilers fire natural gas or fuel oil to produce steam. The wood waste hog fuel boiler fires either natural gas or wood waste to produce steam.

The chemical recovery process recovers chemicals and generates steam needed for the kraft pulping process. The recovery process starts by evaporating weak black liquor obtained from the brown stock pulp washers. The weak black liquor is pumped into three sets of evaporators.

The evaporators consist of six stages or effects, which concentrate the liquor. The liquor is further concentrated in the concentrators to a high solids content to sustain combustion in the recovery furnaces. To replace lost process cooking chemicals t in the chemical recovery loop, salt cake from the production of chlorine dioxide and brown liquor from the NSSC digester are added to the Weak Black Liquor Tank. The black liquor and recycled make up chemicals are combusted after evaporation in the No. 2 and No. 3 Recovery Furnaces. Organics in the concentrated black liquor are oxidized producing steam and various combustion gases and heat. Inorganics from the concentrated black liquor are collected at the bottom of the furnace as a molten mass (smelt) and are gravity fed into the No. 2 and No. 3 Smelt Dissolving Tanks where the smelt is dissolved with weak wash producing green liquor. The resulting green liquor is clarified and is then reacted with calcium oxide from the lime kiln in a slaker to produce white liquor. To ensure a complete reaction of the green liquor and the calcium oxide, the mixture is agitated in a series of causticizers. The suspended solids in the white liquor are separated from the liquor in a clarifier and washed in a lime mud washer. These solids known as lime mud (calcium carbonate) are recycled to a lime kiln to be converted to lime, which is used to make white liquor. The wash water (weak wash) is recycled to the dissolving tank to produce green liquor. The resulting white liquor from this recycling process is stored for reuse in the pulp mill.

Waste Water Treatment

The wastewater treatment plant clarifies and biologically treats the effluent from the mill processes before being discharged to the Columbia River via an outfall line diffuser system. The wastewater effluent enters a clarifier that removes suspended settleable solids from the wastewater. The primary effluent is pumped to a lagoon that biodegrades the waste materials before treatment in a quiescent zone. In the quiescent zone, the settleable biodegradation products and other suspended solids are removed before being pumped to the outfall line diffuser.

II. Assuring Compliance With All Applicable Requirements

An operating permit must contain terms and conditions that assure compliance with all applicable requirements at the time of permit issuance. WAC 173-401-600(1). Certain permit conditions impose a single emission limit or requirement that is based on two or more underlying applicable requirements. The table in Appendix A to this Support Document presents the basis for consolidating these redundant requirements into single permit conditions.

Assuring Continuous Compliance

EPA developed the concept of "gap filling" in response to their interpretation that compliance assurance meant "continuous compliance". The "gap" refers to the subsequent period of time beyond any actual emission monitoring event. In a worst case scenario it is possible that an emission unit may only have been tested for compliance once when new and undergoing initial compliance certification. The subsequent compliance status of the source would then be unknown. The frequency of monitoring imposed by Ecology on Boise Cascade has been far in excess of what would minimally be required by federal regulation. The frequency of monitoring has been stipulated through Orders, which are included in Appendix F of this permit. The

frequency of monitoring compliance is based on best professional judgment of the historical probability of exceeding the imposed limitation and the potential magnitude of an exceedance. Monthly* source tests are required on the significant emission units at the mill. Ecology considers the frequency of monitoring imposed on Boise Cascade adequate to have fulfilled the intent of "gap filling". A summary of the historical emission testing results which served as the basis for determining the frequency of monitoring is included in this document as Appendix B. Pollutants that are monitored "continuously", such as opacity in many cases, are not addressed because the issue of assuring continuous compliance is not applicable.

Copies of the state Regulatory Orders that impose limitations and requirements on the permittee are provided in Appendix F of this permit. The mill-wide order establishes specific limitations for mill's emission units, but also includes general standards established by state regulations. This was done in an effort to incorporate all applicable pollutant specific limitations in one document. The Order is not intended to be a separate legal source for general standards that are based in state regulations. Therefore, for limits derived directly from state regulations that were included in Regulatory Orders for convenience purposes, Ecology considers the regulation and not the Order to be the "applicable requirement" for purposes of Title V. Consequently, the permit does not cite the Order as an applicable requirement for regulatory limits; for these limits, the permit cites only the regulation as the underlying applicable requirement.

For state regulations which were approved the State Implementation Plan, the SIP approved dates in the subparts of 40 CFR 52.2479 are hereby incorporated by reference. Subpart 52.2479 contains the state and local regulations and documents for the Washington SIP including the dates state adopted for compliance with requirements of the Federal Clean Air Act. The regulations have been approved by EPA, and are part of the current federally-approved, implementation plan.

Ecology has preferentially relied on direct source testing as the most robust and accurate method of determining compliance and, through frequency of testing, assuring compliance. Source testing is resource and time intensive. More frequent monitoring requires the use of some sort of indirect surrogate parameter. The frequency of direct source testing has been stipulated through Orders, which are included in Appendix F of this permit. Ecology has attempted to reconcile frequency of monitoring with accuracy of monitoring by relying on both direct periodic source testing and more frequent indirect monitoring using surrogate parameters. Acknowledging the surrogate monitoring parameters as compliance indicators but not necessarily compliance determinants addresses the qualitative concerns regarding surrogate monitoring parameters. Where surrogate monitoring parameters have been employed, the Permit has been structured such that noncompliance with the surrogate limitation requires corrective action. Failure to take corrective action and bring the surrogate parameter within bounds constitutes noncompliance with the need to follow good operation and maintenance as required by WAC 173-405-040(10). The Permit thus combines periodic direct source testing which definitively determines compliance with surrogate monitoring requirements indicating compliance to achieve an overall monitoring program intended to meet the Title V requirement of monitoring sufficient to assure compliance.

The frequency of both direct source testing and the application of surrogate parameters intended to indirectly infer compliance with the underlying applicable requirement is based on best professional judgment of the historical probability of exceeding the imposed limitation and the potential magnitude of an exceedance. A summary of the historical emissions testing results which served as the basis for determining the frequency of monitoring is included in this document as Appendix B.

Emission units such as the lime kilns and smelt tanks have wet scrubbers as emission control equipment or as part of the emission control equipment train. The requirement to monitor and maintain scrubber flow at certain set points was, prior to the advent of Title V Permits, initially imposed as an indicator of proper operation and maintenance regarding opacity and particulate emission minimization. Particulate source testing and visual observations of opacity indicate that the surrogate scrubbing parameters stipulated can be used as indicators of compliance with the opacity and particulate emission limits. Testing done evaluating scrubber flow on the lime kiln versus grain loading indicated that maintaining scrubber flow at greater than 1000 gpm resulted in grain loadings which were in compliance with the standard of 0.0067 gr./dscf, including those with a flow rate below the threshold as illustrated in the document.

For some units, such as recovery furnaces, opacity is proposed as a compliance indicator for particulate emissions. At this time, Ecology does not know of a definitive relationship between opacity and particulate emissions for all emission units such that opacity could be used as a predictive emissions parameter. Nonetheless, there is a relationship such that the opacity levels selected, the opacity limits themselves, are believed to adequately function as surrogate indicators which infer compliance with the underlying applicable requirement. For example, testing done evaluating opacity versus grain loading for RF #4 resulted in a data set that included a maximum opacity of 20 % which correlated to a grain loading of 0.030 gr./dscf. The grain loading limit is .044 gr./dscf for RF #4, and the opacity limit is 35%.

Incorporated into the Permit for the lime kilns, recovery furnaces # 2 an #3, lime kiln, and smelt dissolvers #2 an #3 is an allowance for a reduction in source testing frequency which may be allowed if particulate emission control meets certain criteria. Ecology has introduced this allowance as an incentive to encourage improved emission control. The first criterion, which must be met to allow consideration of source testing frequency reduction, is a proven history of performance. This requires a source to achieve six consecutive months of monthly source testing results that are not greater than 75% of the particulate emission limit. To maintain the reduction in testing frequency no subsequent testing results can be greater than the 75% threshold. If a test result is greater, the testing frequency reverts to a monthly basis until the next six consecutive monthly period of improved performance has occurred.

Simply meeting the 75% threshold is not the only criteria for gaining a reduction in source testing frequency. Subjective criteria are also evaluated and ultimately best professional engineering judgement is exercised. Primary factors also considered include historical emission trends and degree of confidence in maintaining emission limit compliance between source testing events. For example, a unit from which particulate emissions have been historically increasing would probably not gain the source testing frequency allowance. It possibly could be argued that such a unit was already trending toward noncompliance with WAC 173-405-040(10)

which requires operation and maintenance of a facility and emission that operated only periodically probably would not be granted a reduction in monitoring frequency because of possible problems developing from its "mothballed" status. A reduction in testing frequency would also be dependent on the strength of surrogate information available indicating limit compliance between testing events, if a surrogate parameter was deemed control equipment in a manner consistent with good air pollution control practices. Also a unit adequate for compliance indication when coupled with monthly testing but not adequate as a stand-alone compliance indicator, a reduction in testing frequency would not be granted despite achieving the 75% emission allowance threshold.

Where the respective Order is the basis of authority for the required source testing and establishes the frequency of source testing, the mechanism for achieving a reduction in source testing frequency is modification of the underlying Order. The current wording in the title V permit allowing the consideration of such a reduction is designed as a placeholder such that modification of the underlying Order will not require opening the Title V permit for modification. A 30-day public comment period will still occur associated with modification of the Order.

Representative Source Tests

Boise Cascade's (BCC) monthly source tests represent compliance with the standard because the time period over which the sources are tested is representative of the operation of the source throughout the month. The period of source testing is representative of operations during the entire month for the following reasons.

Source tests are 'blind' in nature. The only communication between the testers and operators is to verify that parameters meet or exceed the previous month's average operating conditions. Boiler operators are not given long lead times by the source testers, in order that they may "tune-up" their boiler.

Source tests are conducted at or above the previous month's average operating parameters. Source tests are designed to utilize operating conditions that best emulate past plant operating parameters in order to show continuous compliance. To accomplish this, source tests are conducted at or above the previous month's average operating standards in terms of both production rates and unit operating configurations. It is assumed that the greater the operating parameters, the greater the mass emissions. Thus, if the operating parameters exceed the previous month's averages and still meet standards, the overall assessment is that the source test was representative and the system was in continuous compliance.

Additional surrogate monitoring parameters. In addition to direct source testing conducted periodically, which definitely determines compliance, Ecology has proposed minimum operating conditions in numerous air pollution control equipment as a surrogate monitoring requirements intended to indicate compliance to achieve an overall monitoring program that meets the Title V requirement of monitoring sufficient to assure compliance.

Comments on Specific Permit Conditions

Throughout this support document, an asterisk (*) signifies that frequencies specified as "monthly" may be changed to "quarterly," if permit conditions specified in the permit are met.

Opacity is an indicator of the performance of the electrostatic precipitator, the particulate matter control device. The use of this monitor as a measure of control device performance is consistent with both US. U.S. EPA Region X's interpretation of the applicability of periodic monitoring[i] and with the intent of the Compliance Assurance Monitoring Rule (40 CFR Part 64), that a reasonable assurance of compliance can be demonstrated through a continuous monitoring program of the add-on control device . A table has been added to the document to illustrate the general correlation between opacity and grain loading.

The data included in Appendix E is strong enough to conclude that when the COM reads high opacity readings (above 35%), the control device should be promptly examined to ensure proper operation.

Since the data do not provide evidence that a unique correlation between particulate matter and opacity exists, and since no particulate matter continuous emissions monitor is in place or available, monthly direct particulate source testing in conjunction with COM will serve as the compliance demonstration method for the particulate matter standard.

The permittee is required to verify compliance with the numerous mass loading standards per unit of time at a required frequency as specified in the permit. As an example, Order DE96-AQ-I078 limits particulate matter emissions to 476 pounds per day on a rolling annual average reported monthly. There is more than one way to estimate the mass loading limit, including but not limited to the utilization of actual emissions factors from the numerous stack test results which were conducted over a long period of time. The other methods include the use of EPA's AP-42 Manual, or the data collected from continuous emission monitoring systems (CEMS) in addition to other certified data such as stack flow rate from the EPA Reference methods. The permittee will choose the most reliable and economically reasonable method to verify compliance with the applicable requirements. However, a method may provide a good estimation until an emission unit is modified, or there is a change in the method of operation. The permittee as the consequence may choose another method giving a more reliable and accurate estimation. In this following section, Ecology lists a recommended method to calculate the limit realizing that there may be other ways; therefore, during the course of the permit cycle, the permittee will advise the Department when another method is selected. Ecology's review and approval are required when the new estimation method is proposed by the permittee prior to utilization of the new calculation method.

Condition I.A.3& II.A.3, I.B.2& II.B.3, I.C.3& II.C.3, I.D.3 &II.D.3, I.E.2 &II.E.2

[i] Per presentation by US EPA Region X's Elizabeth Waddell, at October 8, 1997 Title V workshop, and March 19, 1998 Compliance Assurance Monitoring workshop. Each of these workshops were sponsored by the Puget Sound Chapter of the Pacific Northwest International Section of the Air and Waste Management Association.

A continuous opacity monitor (COM) may be used as a performance indicator for some emission units. If a COM is used, the monitor shall take readings and convert the readings into six-minute block averages. For one hour, there shall be 10 six-minute block averages. The first block average of an hour shall be for the time period from 00:00.00 to 00:05.59, the second block average of an hour from 00:06.00 to 00:11.59, and so forth.

COM measurements shall be evaluated once per hour. Corrective actions will commence if, of the 10 six minute block averages in the hour, two or more consecutive blocks are above the given opacity limit, when rounded to the same number of significant digits as the opacity limit.

An important note is that excursions measured by the COM do not necessarily correspond to a violation of the underlying applicable requirement (e.g. opacity limit). The Permittee is required to take corrective action anytime opacity is outside of the levels established in the permit. What constitutes corrective action is intentionally left undefined because it is situation specific. Corrective action can include a visual evaluation of actual opacity in response to exceedance of a trigger mechanism. A visual opacity assessment, as used in this permit, is the use of an observer trained in general procedures for determining visible emissions, which could include DOE Method 9B or EPA Method 9. A trained observer does not need to have current certification in Method 9B. Under normal conditions, a trained observer is expected to be present at the facility, while a certified Method 9B observer may not always be readily available.

Condition I.A.4, I.B.3, IC.4, II.A.4, II.C.4

In 1980, Ecology initiated a requirement that, where continuous sulfur dioxide monitoring was not being performed, a monthly one-hour test for sulfur dioxide was required for recovery furnaces and lime kilns. Wording has been added to the cited permit conditions to clarify the sampling time duration. A copy of the 1980 letter defining the one-hour test is included in Appendix B of the Support Document. The one-hour test of DOE Method 6 is selected for the purpose of periodic monthly source test. For both recovery furnaces and lime kilns, more frequent monitoring is required the use of minimum operating condition. The frequency of both the application of minimum operating condition and direct source testing intended to indirectly infer compliance with the permit limitation is based on best professional judgment of the historical probability of exceeding the limitation and the potential magnitude of an exceedance.

I. No. 2 Recovery Furnace

A. Conditions I.A.2 and II.A.2

Order DE 96-AQ-I078 limits particulate matter (PM) emissions from the No. 2 Recovery Furnace to 476 pounds of PM per day on a rolling annual average. To show compliance with this limit, the permittee , on a monthly* basis, evaluate the

annual average particulate emissions from the No. 2 Recovery Furnace using actual emissions from previous stack test results. As an example to illustrate how mass loading limit is estimated, the following algorithm can be used.

$$\left(\frac{\text{A gr}}{\text{dscf}}\right)\times\left(\frac{\text{B dscf}}{\text{min}}\right)\times\left(\frac{\text{1 lb}}{\text{7,000 gr}}\right)\times\left(\frac{\text{1,440 min}}{\text{day}}\right)=\text{C}\ \frac{\text{lb PM}}{\text{day}}$$

where:

A = volumetric grain loading results from the monthly* EPA Method 5 or equivalent samplings (one 1-hour test)
B = dry standard air flow rate in cubic feet per minute during the monthly* sampling period
C = monthly* average emission rate in pounds per day

This monthly* value will then be averaged with the preceding year of readings in lb/day to determine the rolling annual average.

B. Conditions I.A.4 and II.A.4

Sulfur dioxide (SO_2) emissions from the No. 2 Recovery Furnace are limited to 500 ppm, corrected to 8 percent oxygen, by WAC 173-405-040(11)(a). Many factors affect emissions of SO_2 from recovery furnaces, including mill white liquor sulfidity, black liquor solids feed rate to furnace, furnace temperature, air distribution, and other operational parameters. Because of the numerous variables that affect SO_2 emissions, it is difficult to identify parameters that will give some indication of the emissions. According to U.S. EPA-650/2-74-071-a, *Improved Air Pollution Control for a Kraft Recovery Boiler: Modified Recovery Boiler No. 3*--page 77, white liquor sulfidity is the primary variable affecting SO_2 emissions. Over forty percent of SO_2 emissions were directly correlated to sulfidity levels. This U.S. EPA study concluded that the best indicator for SO_2 emissions is white liquor sulfidity level. Data for the Wallula mill indicate that the No. 2 Recovery Furnace will have reasonable assurance of compliance with WAC 173-405-040(11)(a) when mill white liquor sulfidity does not exceed 33 percent. White liquor sulfidity greater than 33 percent requires the mill to take corrective action, but is not an indicator of noncompliance.

C. Conditions I.A.5 and II.A.5

Order DE 96-AQ-I078 limits sulfur dioxide (SO_2) emissions from the No. 2 Recovery Furnace to 5,424 pounds per day on a rolling annual average. To show compliance with this requirement, the permittee will, on a monthly* basis evaluate the annual average SO_2 emissions from the No. 2 Recovery Furnace using actual

emissions from previous stack test results. As an example to illustrate how mass loading limit is estimated, the following algorithm can be used.

$$\left(\frac{\text{D ppmvd}}{1\times10^{6}}\right)\times\left(\frac{\text{B dscf}}{\text{min}}\right)\times\left(0.166\ \frac{\text{lb SO}_2}{\text{ft}^3\ \text{SO}_2}\right)\times\left(\frac{1{,}440\,\text{min}}{\text{day}}\right)=\ \text{E}\ \frac{\text{lb SO}_2}{\text{day}}$$

where:

B = dry standard air flow rate in cubic feet per minute during monthly* sampling period
D = DOE Method 6, or equivalent, SO_2 concentration based on monthly* sample (one 1-hour test)
E = monthly* average SO_2 emission rate in pounds per day

This value will then be averaged with the preceding year of monthly* calculated SO_2 emission rates to determine the rolling annual average.

The density of sulfur dioxide, 0.166 lb SO_2 per cubic foot of SO_2, is taken from Method 19.

D. Conditions I.A.7 and II.A.7

Opacity is an indicator of the performance of the electrostatic precipitator, the particulate matter control device. The use of this monitor as a measure of control device performance is consistent with both US. EPA's Region X's interpretation of the applicability of periodic monitoring[ii] and with the intent of the Compliance Assurance Monitoring Rule (40 CFR Part 64), that a reasonable assurance of compliance can be demonstrated through a control device performance indicator. With a R^2 value of 0.6375 (See table in Appendix E), opacity is a good general indictor of control device performance but is not significant enough to make a direct linear correlation. Nevertheless, the correlation is strong enough to conclude that when the COM reads high opacity readings (above 35%), the control device and/or monitor should be promptly examined to ensure proper operation.

II. No. 3 Recovery Furnace

A. Condition I.B.1 and II.B.1

The source test is representative of compliance for the same reasons listed in Ecology's response to Condition I.A.1, Comment 1.

[ii] Per presentation by US EPA Region X's Elizabeth Waddell, at October 8, 1997 Title V workshop, and March 19, 1998 Compliance Assurance Monitoring workshop. Each of these workshops were sponsored by the Puget Sound Chapter of the Pacific Northwest International Section of the Air and Waste Management Association.

B. Condition I.B.3

Sulfur dioxide (SO_2) emissions from the No. 3 Recovery Furnace are limited to 500 ppm, corrected to 8 percent oxygen, by WAC 173-405-040(11)(a). Many factors affect emissions of SO_2 from recovery furnaces, including mill white liquor sulfidity, black liquor solids feed rate to furnace, furnace temperature, air distribution, and other operational parameters. Because of the numerous variables that affect SO_2 emissions, it is difficult to identify parameters that will give some indication of the emissions. According to U.S. EPA-650/2-74-071-a, *Improved Air Pollution Control for a Kraft Recovery Boiler: Modified Recovery Boiler No. 3*--page 77, white liquor sulfidity is the primary variable affecting SO_2 emissions. Over forty percent of SO_2 emissions was directly correlated to sulfidity levels. This U.S. EPA study concluded that the best indicator for SO_2 emissions is white liquor sulfidity level. Data for the Wallula mill indicate that the No. 3 Recovery Furnace will have reasonable assurance of compliance with WAC 173-405-040(11)(a) when mill white liquor sulfidity does not exceed 33 percent. White liquor sulfidity greater than 33 percent requires the mill to take corrective action, but is not an indicator of noncompliance.

B. Condition II.B.2

Order DE 96-AQ-I078 limits particulate (PM) emissions from the No. 3 Recovery Furnace to 186 tons per year on a rolling annual average basis. To show compliance with this requirement, the permittee will evaluate the annual average particulate emissions from the No. 3 Recovery Furnace on a monthly* basis using actual emissions from previous stack test results. As an example to illustrate how mass loading limit is estimated, the following algorithm can be used.

$$\frac{\left(\frac{\text{A gr}}{\text{dscf}}\right)\times\left(\frac{\text{B dscf}}{\text{min}}\right)\times\left(\frac{1440\text{ min}}{\text{1 day}}\right)}{\left(\frac{\text{C ton}}{\text{day}}\right)}\times\left(\frac{\text{1 lb}}{\text{7,000 gr}}\right)\times\left(\frac{\text{1 ton}}{\text{2,000 lb}}\right)\times\left(\frac{\text{D tons}}{\text{month}}\right)=\text{E}\ \frac{\text{ton PM}}{\text{month}}$$

where:

A = volumetric grain loading from the monthly* EPA Method 5 or equivalent samplings (one 1-hour test per month)
B = dry standard air flow rate in cubic feet per minute during PM sampling period
C = tons of BLS fired in the No. 3 Recovery Furnace on the day sampling is performed
D = tons of BLS fired in the No. 3 Recovery Furnace for the month*
E = monthly* average emission rate in tons per month*

This monthly* value will then be summed with the preceding year of readings to determine the rolling annual average.

C. Condition I.B.4 and II.B.17

Opacity is an indicator of the performance of the electrostatic precipitator, the particulate matter control device. The use of this monitor as a measure of control device performance is consistent with both US. EPA's Region X's interpretation of the applicability of periodic monitoring[iii] and with the intent of the Compliance Assurance Monitoring Rule (40 CFR Part 64), that a reasonable assurance of compliance can be demonstrated through a control device performance indicator. With a R^2 value of 0.9288 (See table in Appendix E), opacity is a good general indicator of control device performance but is not significant enough to make a direct linear correlation. Nevertheless, the correlation is strong enough to conclude that when the COM reads high opacity readings (above 35%), the control device and/or monitor should be promptly examined to ensure proper operation.

D. Condition II.B.8

Order DE 96-AQ-I078 limits sulfur dioxide (SO_2) emissions from the No. 3 Recovery Furnace to 1,592 tons per year on an annual average basis. To show compliance with this requirement, the permittee will evaluate the annual average SO_2 emissions from the No. 3 Recovery Furnace using actual test results and continuous emission monitoring (CEM) data. As an example to illustrate how mass loading limit is estimated, the following algorithm can be used.

$$\left(\frac{\text{F ppmvd}}{1\times10^{6}}\right)\times\left(\frac{\text{B dscf}}{\text{min}}\right)\times\left(0.166\ \frac{\text{lb SO}_2}{\text{ft}^3\ \text{SO}_2}\right)\times\left(\frac{\text{1 ton}}{\text{2,000 lb}}\right)\times\left(\frac{\text{60 min}}{\text{hr}}\right)\times\left(\frac{\text{G hrs}}{\text{month}}\right)=\text{H}\ \frac{\text{ton SO}_2}{\text{month}}$$

where:

B = dry standard air flow rate in cubic feet per minute during most recent PM sampling period (see above Section II.A)
F = SO_2 concentration measured by a continuous emission monitoring system. The monthly average will be calculated based on the sum of valid individual hourly averages divided by the total number of valid hourly averages available.
G = operating hours per month
H = SO_2 emission rate in tons per month

[iii] Per presentation by US EPA Region X's Elizabeth Waddell, at October 8, 1997 Title V workshop, and March 19, 1998 Compliance Assurance Monitoring workshop. Each of these workshops were sponsored by the Puget Sound Chapter of the Pacific Northwest International Section of the Air and Waste Management Association.

At the end of the calendar year, the monthly values for the year will be summed to determine the annual average.

The density of sulfur dioxide, 0.166 lb SO_2 per cubic foot of SO_2, is taken from Method 19.

E. Condition II.B.10

Order DE 96-AQ-I078 limits nitrogen oxides (NO_x) emissions from the No. 3 Recovery Furnace to 825 tons per year on an annual average basis. To show compliance with this requirement, the permittee will evaluate the annual average NO_x emissions from the No. 3 Recovery Furnace using actual test results and CEM data. As an example to illustrate how mass loading limit is estimated, the following algorithm can be used.

$$\left(\frac{\text{I ppmvd}}{1\times10^{6}}\right)\times\left(\frac{\text{B dscf}}{\text{min}}\right)\times\left(0.1194\ \frac{\text{lb NO}_x}{\text{ft}^3\ \text{NO}_x}\right)\times\left(\frac{60\,\text{min}}{\text{hr}}\right)\times\left(\frac{1\ \text{ton}}{2{,}000\ \text{lb}}\right)\times\left(\frac{\text{G hours}}{\text{month}}\right)=\ \text{J}\ \frac{\text{ton NO}_x}{\text{month}}$$

where:

B = dry standard air flow rate in cubic feet per minute during most recent PM sampling period (see above Section II.A)
G = operating hours per month
I = NO_x concentration measured by a continuous emission monitoring system. The monthly average will be calculated based on the sum of valid individual hourly averages divided by the total number of valid hourly averages available.
J = NO_x emission rate in tons per month

At the end of the calendar year, the monthly values for the year will be summed to determine the annual average.

The density of nitrogen oxide, 0.1194 lb NO_x per cubic foot of NO_x, is taken from Method 19.

F. Condition II.B.12

Order DE 96-AQ-I078 limits carbon monoxide (CO) emissions from the No. 3 Recovery Furnace to 1,355 tons per year on an annual average basis. To show compliance with this requirement, the permittee will evaluate the annual average CO emissions from the No. 3 Recovery Furnace using actual test results and CEM data. As an example to illustrate how mass loading limit is estimated, the following algorithm can be used.

$$\left(\frac{\text{K ppmvd}}{1\times10^{6}}\right)\times\left(\frac{\text{B dscf}}{\text{min}}\right)\times\left(0.0728\ \frac{\text{lb CO}}{\text{ft}^3\ \text{CO}}\right)\times\left(\frac{60\,\text{min}}{\text{hr}}\right)\times\left(\frac{1\ \text{ton}}{2{,}000\ \text{lb}}\right)\times\left(\frac{\text{G hours}}{\text{month}}\right)=\ \text{L}\ \frac{\text{ton CO}}{\text{month}}$$

where:

B = dry standard air flow rate in cubic feet per minute during most recent PM sampling period (see above Section II.A)
G = operating hours per month
K = CO concentration measured by a continuous emission monitoring system. The monthly average will be calculated based on the sum of valid individual hourly averages divided by the total number of valid hourly averages available.
L = CO emission rate in ton per month

At the end of the calendar year, the monthly values for the year will be summed to determine the annual average.

The density of carbon monoxide, 0.0728 lb CO per cubic foot of CO, is based on a molecular weight of 28 lb/lb mol and an ideal gas volume of standard conditions of 385 ft^3/lb mol.

G. Condition II.B.13

The source test is representative of compliance for the same reasons listed in Ecology's response to Condition I.A.1, Comment 1. Ecology will mandate that the test will be conducted at full load to maximize exhaust temperature and airflow, and thus VOC emissions. Based on best professional judgment, the test will be hence conducted under the most stringent condition as stated, VOC emissions during the normal operation are unlikely to exceed the emissions during the compliance test.

H. Condition II.B.14

Order DE 96-AQ-I078 limits volatile organic compounds (VOC) emissions from the No. 3 Recovery Furnace to 179 tons per year on an annual average basis. To show compliance with this requirement, the permittee will evaluate the annual average VOC emissions from the No. 3 Recovery Furnace on an annual basis using actual emissions from previous stack test. As an example to illustrate how mass loading limit is estimated, the following algorithm can be used.

$$\left(\frac{\text{M lb}}{\text{MMBtu}}\right)\times\left(\frac{\text{N MMBtu}}{\text{year}}\right)\times\left(\frac{1\ \text{ton}}{2{,}000\ \text{lb}}\right)=\ \text{P}\ \frac{\text{ton VOC}}{\text{year}}$$

where:

M = VOC concentration in lb/MMBtu from sample test using Method 25A or equivalent method found to be acceptable by the Department, conducted once every five years.
N = annual heat input to the No. 3 Recovery Furnace
P = annual average emission rate in tons per year

J. Condition II.B.16

Order DE 96-AQ-I078 limits total reduced sulfur (TRS) emissions from the No. 3 Recovery Furnace to 27 tons per year on an annual average basis. To show compliance with this requirement, the permittee will evaluate the annual average TRS emissions from the No. 3 Recovery Furnace using actual stack test information and CEM data. As an example to illustrate how mass loading limit is estimated, the following algorithm can be used.

$$\left(\frac{\text{P ppmvd}}{1\times10^{6}}\right)\times\left(\frac{\text{B dscf}}{\text{min}}\right)\times\left(0.0883\ \frac{\text{lb TRS as } H_2S}{\text{ft}^3\text{ TRS as } H_2S}\right)\times\left(\frac{60\,\text{min}}{\text{hr}}\right)\times\left(\frac{1\text{ ton}}{2{,}000\text{ lb}}\right)\times\left(\frac{\text{G hrs}}{\text{month}}\right)=\text{Q}\ \frac{\text{ton TRS as } H_2S}{\text{month}}$$

where:

B = dry standard air flow rate in cubic feet per minute during PM sampling period
G = operating hours per month*
P = TRS concentration measured by a continuous emission monitoring system. The monthly average will be calculated based on the sum of valid individual hourly averages divided by the total number of valid hourly averages available.
Q = TRS emission rate in ton per month*

At the end of the calendar year, the monthly* values for the year will be summed to determine the annual average.

The density of total reduced sulfur, 0.0883 lb TRS per cubic foot of TRS, is based on a molecular weight of 34 lb/lb mol and an ideal gas volume at standard conditions of 385 ft^3/lb mol.

K. Condition II.B.17

Opacity is an indicator of the performance of the electrostatic precipitator, the particulate matter control device. The use of this monitor as a measure of control device performance is consistent with both US. U.S. EPA Region X's

interpretation of the applicability of periodic monitoring[iv] and with the intent of the Compliance Assurance Monitoring Rule (40 CFR Part 64), that a reasonable assurance of compliance can be demonstrated through a continuous monitoring program of the add-on control device.

III. Lime Kiln

A. Condition I.C.1 and IIC.1

The source test is representative of compliance for the same reasons listed in Ecology's response to Condition I.A.1, Comment 1. Refer to the scrubber flow rate vs. particulate emissions in Condition I.C.8, which provides the basis to support the best professional and engineering judgment that the scrubber flow rate, when within the prescribed range, can be used as the compliance indicator of the particulate emissions.

Flow rate is an indicator of the performance of the scrubber, the particulate matter control device. By design, the unit is in compliance with the particulate and opacity standards when adequate flow is delivered to the scrubber unit, as verified in previous source tests. The 20 gpm threshold, as an indicator of control device performance, is based on historical evidence, source testing, and good engineering judgement. The use of this monitor as a measure of control device performance is consistent with both US. EPA Region X's interpretation of the applicability of periodic monitoring[v] and with the intent of the Compliance Assurance Monitoring Rule (40 CFR Part 64), that a reasonable assurance of compliance can be demonstrated through a control device performance indicator.

B. Condition I.C.2 and II.C.2

Order DE 96-AQ-I078 limits particulate matter (PM) emissions from fuel oil combustion in the Lime Kiln to 906 pounds of PM per day on a rolling annual average basis. To show compliance with this limit, the permittee will, on a monthly* basis, evaluate the annual average PM emissions from fuel oil combustion in the Lime Kiln using actual emissions from previous stack test results. If no fuel oil was fired during the test, results from the most recent test in which fuel oil was fired will be reported. As an example to illustrate how mass loading limit is estimated, the following algorithm can be used.

[iv] Per presentation by US EPA Region X's Elizabeth Waddell, at October 8, 1997 Title V workshop, and March 19, 1998 Compliance Assurance Monitoring workshop. Each of these workshops were sponsored by the Puget Sound Chapter of the Pacific Northwest International Section of the Air and Waste Management Association.

[v] Per presentation by US EPA Region X's Elizabeth Waddell, at October 8, 1997 Title V workshop, and March 19, 1998 Compliance Assurance Monitoring workshop. Each of these workshops were sponsored by the Puget Sound Chapter of the Pacific Northwest International Section of the Air and Waste Management Association.

$$\left(\frac{\text{A gr}}{\text{dscf}}\right)\times\left(\frac{\text{B dscf}}{\text{min}}\right)\times\left(\frac{\text{1 lb}}{\text{7,000 gr}}\right)\times\left(\frac{\text{1,440 min}}{\text{day}}\right)=\text{C}\ \frac{\text{lb PM}}{\text{day}}$$

where:

A = volumetric grain loading results from the monthly* EPA Method 5 or equivalent tests (one 1-hour test per month) with the Lime Kiln firing fuel oil

B = dry standard air flow rate in cubic feet per minute from the most recent monthly* sampling with the Lime Kiln firing fuel oil

C = monthly* average emission rate in pounds per day from the Lime Kiln when firing fuel oil

This monthly* value will then be averaged with the preceding year of Lime Kiln fuel oil based readings to determine the rolling annual average.

Order DE 96-AQ-I078 limits PM emissions from natural gas combustion in the Lime Kiln to 466 pounds of PM per day on a rolling annual average. To show compliance with DE 96-AQ-I078, the permittee will, on a monthly* basis, evaluate the annual average PM emissions from natural gas combustion in the Lime Kiln using the actual emissions from previous stack test. If no natural gas was fired during the test, results from the most recent test in which natural gas was fired will be reported.

$$\left(\frac{\text{D gr}}{\text{dscf}}\right)\times\left(\frac{\text{B dscf}}{\text{min}}\right)\times\left(\frac{\text{1 lb}}{\text{7,000 gr}}\right)\times\left(\frac{\text{1,440 min}}{\text{day}}\right)=\text{E}\ \frac{\text{lb PM}}{\text{day}}$$

where:

D = volumetric grain loading results from the monthly* EPA Method 5 or equivalent tests (one 1-hour test per month) with the Lime Kiln firing natural gas

B = dry standard air flow rate in cubic feet per minute from the most recent monthly* sampling with the Lime Kiln firing natural gas

E = monthly* average emission rate in pounds per day from the Lime Kiln when firing natural gas

This monthly* value will then be averaged with the preceding year of Lime Kiln natural gas based readings to determine the rolling annual average.

B. Condition I.C.3 and II.C.3

The source test is representative of compliance for the same reasons listed in Ecology's response to Condition I.A.1, Comment 1.

C. Condition I.C.4 and II.C.4

Industry history and source testing have shown that there are no compliance issues due to the alkaline nature of the scrubbing liquid. The physical-chemical properties of the scrubbing medium (i.e. lime dust) and intrinsic design of the scrubber inherently allows for the removal of the SO_2.

D. Condition I.C.5 and II.C.5

The source test is representative of compliance for the same reasons listed in Ecology's response to Condition I.A.1, Comment 1.

E. Condition I.C.6 and II.C.6

Order DE 96-AQ-I078 limits sulfur dioxide (SO_2) emissions from the Lime Kiln to 19 pounds per day on a rolling annual average basis. To show compliance with this requirement, the permittee will, on a quarterly basis, evaluate the annual average SO_2 emissions from the Lime Kiln using the actual emissions from previous stack test. As an example of how the emission may be estimated using the actual stack test results, the following calculations may be used. Note that methods of estimation are not inclusive.

$$\left(\frac{\text{F ppmvd}}{1\times10^{6}}\right)\times\left(\frac{\text{B dscf}}{\text{min}}\right)\times\left(0.166\ \frac{\text{lb SO}_2}{\text{ft}^3\ \text{SO}_2}\right)\times\left(\frac{1{,}440\,\text{min}}{\text{day}}\right)=\text{G}\ \frac{\text{lb SO}_2}{\text{day}}$$

where:

B = dry standard air flow rate in cubic feet per minute during the most recent quarterly particulate sampling period
F = quarterly DOE Method 6 or equivalent SO_2 concentrations (one 1-hour test per quarter)
G = quarterly average SO_2 emission rate in pounds per day

This value will then be averaged with the preceding year of readings to determine the rolling annual average.

The density of sulfur dioxide, 0.166 lb SO_2 per cubic foot of SO_2, is taken from Method 19.

D. Condition I.C.8 and II.C.8

Flow rate is an indicator of the performance of the scrubber, the particulate matter control device. By design, the unit is in compliance with the particulate and opacity standards when adequate flow is delivered to the scrubber unit. The

1,000 gpm threshold, as an indicator of control device performance, is based on historical evidence, source testing, and good engineering judgement. The use of this monitor as a measure of control device performance is consistent with both US. EPA's Region X's interpretation of the applicability of periodic monitoring[vi] and with the intent of the Compliance Assurance Monitoring Rule (40 CFR Part 64), that a reasonable assurance of compliance can be demonstrated through a control device performance indicator. This monitoring method was approved by the U.S. EPA as alternate indicator for lime kiln scrubber performance.

Stack tests during the period of 1/97 through 7/98 were conducted with scrubber flows greater than 1,000 gpm. All were in compliance with the standard of 0.067 gr./dscf, to include those with a flow rate below the threshold. The following table illustrates the results of these stack tests.

Date	**Particulate** gr./dscf	**Scrubber. Flow** gpm
7/8/98	0.031	1254
6/10/98	0.067	1252
5/18/96	0.039	877
4/30/98	0.057	1250
1/8/98	0.030	1252
10/8/97	0.038	1259
7/31/97	0.016	1249
5/8/97	0.037	1245
4/22/97	0.045	1247
3/24/97	0.049	1248
2/24/97	0.013	1255
1/21/97	0.035	1237

In addition to the scrubber flow rate requirement, the permittee will monitor the pressure drop as required by 40 CFR 284(b)(2)(i).

E. Condition I.C.9 and II.C.9

WAC 173-405-040(3)(b) limits total reduced sulfur (TRS) emission concentrations from the Lime Kiln to 80 parts per million corrected to 10 percent oxygen on a period of two consecutive hours. 40 CFR 60.283(a)(5) limits TRS emission concentrations from the Lime Kiln to 8 parts per million corrected to 10 percent oxygen. As identified in Order DE 96-AQ-I078, Boise will operate a continuous emission monitor for TRS on the Lime Kiln with a range of 0 to 30

[vi] Per presentation by US EPA Region X's Elizabeth Waddell, at October 8, 1997 Title V workshop, and March 19, 1998 Compliance Assurance Monitoring workshop. Each of these workshops were sponsored by the Puget Sound Chapter of the Pacific Northwest International Section of the Air and Waste Management Association.

ppmvd compliance with the 8 ppmvd limit. Boise will use the results of this monitoring to show compliance with the 80 ppmvd limit as well. Readings at or below 30 ppmvd will be considered in compliance with the 80 ppmvd limit.

IV. No. 2 Smelt Dissolving Tank

A. Conditions I.D.1, I.D.2, II.D.1, and II.D.2

40 CFR 60.282(a)(2) limits particulate matter (PM) emissions from the No. 2 SDT to 0.2 lb/ton BLS. To show compliance with this requirement, the permittee will, on a monthly* basis, use results obtained from DOE Method 5 or equivalent. As an example of how the emission may be estimated using the actual stack test results, the following calculations may be used. Note that methods of estimation are not inclusive.

$$\frac{\left(H\ \frac{\text{lb PM}}{\text{hr}}\right)}{\left(\frac{\text{I ton BLS}}{\text{hr}}\right)} = J\frac{\text{lb PM}}{\text{ton BLS}}$$

where:

H = PM emission rate per hour from monthly* EPA Method 5 or equivalent (one 1-hour test)
I = tons of black liquor solids combusted in the No. 2 Recovery Furnace during the hour the grain loading sample was taken (daily ton BLS/hours of operation is acceptable)
J = emission factor in pounds per ton of black liquor solids, hourly average

Order DE 96-AQ-I078 limits PM emissions from the No. 2 SDT to 71 pounds of PM per day on a rolling annual average. To show compliance with Order DE 96-AQ-I078, the permittee will, on a monthly* basis, evaluate the annual average PM emissions from the No. 2 SDT using actual emissions from previous results. As an example of how the emission may be estimated using the actual stack test results, the following calculations may be used. Note that methods of estimation are not inclusive.

$$\left(\frac{\text{K gr}}{\text{dscf}}\right)\times\left(\frac{\text{B dscf}}{\text{min}}\right)\times\left(\frac{\text{1 lb}}{\text{7,000 gr}}\right)\times\left(\frac{\text{60 min}}{\text{hr}}\right) = L\ \frac{\text{lb PM}}{\text{hr}}$$

where:

B = dry standard air flow rate in cubic feet per minute during sampling period
K = volumetric grain loading results from monthly* EPA Method 5 or equivalent sampling (one 1-hour test)
L = monthly* average emission rate in pounds per day

This value will then be averaged with the preceding year of readings to determine the rolling annual average.

B. Condition I.D.3 and II.D.3

Flow rate is an indicator of the performance of the scrubber, the particulate matter control device. By design, the unit is in compliance with the particulate and opacity standards when adequate flow is delivered to the scrubber unit, as verified in previous source tests. The 20 gpm threshold, as an indicator of control device performance, is based on historical evidence, source testing, and good engineering judgement. The use of this monitor as a measure of control device performance is consistent with both US. EPA Region X's interpretation of the applicability of periodic monitoring[vii] and with the intent of the Compliance Assurance Monitoring Rule (40 CFR Part 64), that a reasonable assurance of compliance can be demonstrated through a control device performance indicator.

C. Condition I.D.4 and II.D.4

WAC 173-405-040(2) and 40 CRF 60.283(a)(4) limit total reduced sulfur (TRS) emissions from the No. 2 SDT to 0.033 lbs/ton BLS annual average. To show compliance with this requirement, Boise will, on an annual basis, evaluate the annual TRS emissions from the No. 2 SDT using actual emissions from previous stack test results. As an example of how the emission may be estimated using the actual stack test results, the following calculations may be used. Note that methods of estimation are not inclusive.

$$\frac{\left(M\ \frac{\text{lb TRS}}{\text{hr}}\right)}{\left(\frac{\text{N ton BLS}}{\text{hr}}\right)} = P\frac{\text{lb TRS}}{\text{ton BLS}}$$

where:

M = TRS emission rate per hour from annual testing using Method 16A/6C bag sample or equivalent method.

[vii] Per presentation by US EPA Region X's Elizabeth Waddell, at October 8, 1997 Title V workshop, and March 19, 1998 Compliance Assurance Monitoring workshop. Each of these workshops were sponsored by the Puget Sound Chapter of the Pacific Northwest International Section of the Air and Waste Management Association.

N = tons of black liquor solids combusted in the No. 2 Recovery Furnace during the time the annual TRS sample was taken
P = annual emission factor in pounds per ton of black liquor solids

C. Condition I.D.5 and II.D.5

Flow rate is an indicator of the performance of the scrubber, the particulate matter control device. By design, the unit is in compliance with the particulate and opacity standards when adequate flow is delivered to the scrubber unit, as verified in previous source tests. The 20 gpm threshold, as an indicator of control device performance, is based on historical evidence, source testing, and good engineering judgement. The use of this monitor as a measure of control device performance is consistent with both US. EPA Region X's interpretation of the applicability of periodic monitoring[viii] and with the intent of the Compliance Assurance Monitoring Rule (40 CFR Part 64), that a reasonable assurance of compliance can be demonstrated through a control device performance indicator.

Stack tests during the period of 9/97 through 7/98 were conducted with scrubber flows greater than 20 gpm. All were in compliance with the standard of 0.2 lbs/ton. The following table illustrates the results of these stack tests.

Date	**Scrubber Flow** gpm	**Particulate** gr./dscf
9/11/97	88	0.2
9/18/97	109	0.2
9/24/97	110	0.1
10/9/97	109	0.2
11/13/97	103	0.1
12/5/97	99	0.1
1/21/98	93	0.19
2/11/98	84	0.1
3/19/98	84	0.1
4/28/98	95	0.1
7/9/98	110	0.1

V. No. 3 Smelt Dissolving Tank

A. Conditions I.E.1 and II.E.1

[viii] Per presentation by US EPA Region X's Elizabeth Waddell, at October 8, 1997 Title V workshop, and March 19, 1998 Compliance Assurance Monitoring workshop. Each of these workshops were sponsored by the Puget Sound Chapter of the Pacific Northwest International Section of the Air and Waste Management Association.

WAC 173-405-040(2) limits particulate (PM) emissions from the No. 3 SDT to 0.3 lbs/ton BLS on an hourly average. To show compliance with this requirement, Boise will, on a monthly* basis, use results obtained from DOE Method 5 or equivalent.. As an example of how the emission may be estimated using the actual stack test results, the following calculations may be used. Note that methods of estimation are not inclusive.

$$\frac{\left(A\ \frac{\text{lb PM}}{\text{hr}}\right)}{\left(\frac{\text{B ton BLS}}{\text{hr}}\right)} = C\frac{\text{lb PM}}{\text{ton BLS}}$$

where:

A = PM emission rate per hour
B = tons of black liquor solids combusted in the No. 2 Recovery Furnace during the hour the grain loading sample was taken (daily ton BLS/hours of operation is acceptable)
C = emission factor in pounds per ton of black liquor solids, hourly average

C. Condition I.E.2 and II.E.2

While Method 9 is the reference test method, Ecology had not intended to require Method 9 monitoring at any given frequency. That is not to say that Method 9 monitoring cannot be performed, or that Method 9 monitoring cannot be used as credible evidence of compliance or non-compliance by BCC, Ecology, or a third party.

Ecology has chosen to require a surrogate parameter, scrubber liquid flow, as a compliance indicator. This discussion includes the results of BCC's analysis for Ecology regarding representative compliance with the standard as part of the consolidation order in 1996. The analysis illustrated in the Support Document showed that during stack tests above the minimum operating flow of 20 gpm, the source was in compliance with both the grain loading and opacity limits. Ecology concluded that, based on our professional and engineering judgment, the standard is unlikely to be exceeded under the normal operating condition when using the scrubber flow rate of 20 GPM.

D. Condition I.E.3 and II.E.3

Flow rate is an indicator of the performance of the scrubber, the particulate matter control device. By design, the unit is in compliance with the particulate and opacity standards when adequate flow is delivered to the scrubber unit. The 20

gpm threshold, as an indicator of control device performance, is based on historical evidence, source testing, and good engineering judgement. The use of this monitor as a measure of control device performance is consistent with both US. EPA Region X's interpretation of the applicability of periodic monitoring[ix] and with the intent of the Compliance Assurance Monitoring Rule (40 CFR Part 64), that a reasonable assurance of compliance can be demonstrated through a control device performance indicator. This monitoring method was approved by the U.S. EPA as an alternate indicator for lime kiln scrubber performance and is appropriate to be used on the SDTV.

Stack tests during the period of 10/97 through 7/98 were conducted with scrubber flows greater than 20 gpm. All were in compliance with the standard of 0.3 lbs./TBLS (ton of black liquor solids). The following table illustrates the results of these stack tests.

Date	**Scrubber Flow** gpm	**Particulate*** Lbs./TBLS
10/17/97	54	0.189
1/22/98	34	0.133
4/27/98	54	0.135
5/14/98	39	0.095
6/11/98	45	0.141
7/15/98	46	0.152

VI. Hog Fuel Boiler

A. Conditions I.F.1 and II.F.1

Flow rate is an indicator of the performance of the scrubber, the particulate matter control device. By design, the unit is in compliance with the particulate and opacity standards when adequate flow is delivered to the scrubber unit, as verified in previous source tests. The 800 gpm threshold, as an indicator of control device performance, is based on historical evidence, source testing, and good engineering judgement. The use of this monitor as a measure of control device performance is consistent with both US. EPA Region X's interpretation of the applicability of periodic monitoring[x] and with the intent of the Compliance Assurance Monitoring Rule (40 CFR Part 64), that a reasonable assurance of compliance can be demonstrated through a control device performance indicator.

[ix] Per presentation by US EPA Region X's Elizabeth Waddell, at October 8, 1997 Title V workshop, and March 19, 1998 Compliance Assurance Monitoring workshop. Each of these workshops were sponsored by the Puget Sound Chapter of the Pacific Northwest International Section of the Air and Waste Management Association.

[x] Per presentation by US EPA Region X's Elizabeth Waddell, at October 8, 1997 Title V workshop, and March 19, 1998 Compliance Assurance Monitoring workshop. Each of these workshops were sponsored by the Puget Sound Chapter of the Pacific Northwest International Section of the Air and Waste Management Association.

B. Conditions I.F.2 and II.F.2

Order DE 96-AQ-I078 limits particulate (PM) emissions from the Hog Fuel Boiler to 459 pounds of PM per day on a rolling annual average basis. To show compliance with Order DE 96-AQ-I078, Boise will, on a quarterly basis, evaluate the annual average PM emissions from the Hog Fuel Boiler using actual emissions from previous stack test results. As an example of how the emission may be estimated using the actual stack test results, the following calculations may be used. Note that methods of estimation are not inclusive.

$$\left(\frac{\text{D gr}}{\text{dscf}}\right) \times \left(\frac{\text{B dscf}}{\text{min}}\right) \times \left(\frac{\text{1 lb}}{\text{7,000 gr}}\right) \times \left(\frac{\text{1,440 min}}{\text{day}}\right) = \text{E } \frac{\text{lb PM}}{\text{day}}$$

where:

B = dry standard air flow rate in cubic feet per minute during sampling period
D = volumetric grain loading results from quarterly EPA Method 5 or equivalent (three 1-hour tests quarterly)
E = quarterly average emission rate in pounds per day

This value will then be averaged with the preceding year of readings to determine the rolling annual average.

C. Conditions I.F.3 and II.F.3

Flow rate is an indicator of the performance of the scrubber, the particulate matter control device. By design, the unit is in compliance with the particulate and opacity standards when adequate flow is delivered to the scrubber unit. The 800 gpm threshold, as an indicator of control device performance, is based on historical evidence, source testing, and good engineering judgement. The use of this monitor as a measure of control device performance is consistent with both US. EPA Region X's interpretation of the applicability of periodic monitoring[xi] and with the intent of the Compliance Assurance Monitoring Rule (40 CFR Part 64), that a reasonable assurance of compliance can be demonstrated through a control device performance indicator. This monitoring method was approved by the U.S. EPA as an alternate indicator for lime kiln scrubber performance and is appropriate to be used on the hog-fuel boiler.

D. Conditions I.F.4 and II.F.4

[xi] Per presentation by US EPA Region X's Elizabeth Waddell, at October 8, 1997 Title V workshop, and March 19, 1998 Compliance Assurance Monitoring workshop. Each of these workshops were sponsored by the Puget Sound Chapter of the Pacific Northwest International Section of the Air and Waste Management Association.

Flow rate is an indicator of the performance of the scrubber, the particulate matter control device. By design, the unit is in compliance with the particulate and opacity standards when adequate flow is delivered to the scrubber unit. The 800 gpm threshold, as an indicator of control device performance, is the best parametric monitoring method available. The use of this monitor as a measure of control device performance is consistent with both US. EPA's Region X's interpretation of the applicability of periodic monitoring[xii] and with the intent of the Compliance Assurance Monitoring Rule (40 CFR Part 64), that a reasonable assurance of compliance can be demonstrated through a control device performance indicator.

VII. No. 1 and No. 2 Power Boilers

The No. 1 and No. 2 Power Boilers assure compliance when firing natural gas and fuel oil based on the following calculations:

A. Conditions I.G.1, II.G.1, I.H.1, and II.H.1

The No.1 and No.2 Power Boilers are limited to 0.1 gr./dscf corrected to 7%, hourly average.

For particulate matter (PM) emissions from natural gas:

- 5 lb PM/MMcf natural gas. (Taken from Table 1.4-2 of AP-42 (10/96) for natural gas combustion in a large industrial boiler.)
- F_d = 8,710 dscf/MMBtu for natural gas. ("F" factor from 40 CFR, Part 60, App. A, Method 19)
- Conversion factor of 1,035 MMBtu/MMcf natural gas

$$5\frac{lb}{MMcf}\times\frac{1\,MMcf}{1{,}035\,MMBtu}\times\frac{1\,MMBtu}{8{,}710\,dscf}\times 7{,}000\frac{gr}{lb}\times\frac{20.9-7.0}{20.9}=0.003\frac{gr}{dscf}$$

Therefore, the maximum actual particulate emissions of 0.003 gr./dscf corrected to 7% O_2 generated from natural gas combustion are less than the permit limit value of 0.1 gr./dscf. No ongoing compliance demonstration measures are required when firing natural gas.

For PM emissions from fuel oil:

[xii] Per presentation by US EPA Region X's Elizabeth Waddell, at October 8, 1997 Title V workshop, and March 19, 1998 Compliance Assurance Monitoring workshop. Each of these workshops were sponsored by the Puget Sound Chapter of the Pacific Northwest International Section of the Air and Waste Management Association.

- [9.19(S)+3.22] lb/1000 gallons fuel oil. (Taken from Table 1.3-1 of AP-42 (10/96) for fuel oil combustion in a utility boiler.) For 2 percent sulfur content, fuel oil this equates to a particulate matter emission factor of 21.6 lb/1000 gal

- F_d = 9,190 dscf/MMBtu for oil. ("F" factor from 40 CFR, Part 60, App. A, Method 19)

- Conversion factor of 141 MMBtu/1000 gallon fuel oil

$$21.6\frac{lb}{1000\,gal}\times\frac{1000\,gal}{141\,MMBtu}\times\frac{1\,MMBtu}{9{,}190\,dscf}\times 7{,}000\frac{gr}{lb}\times\frac{20.9-7.0}{20.9}=0.08\frac{gr}{dscf}$$

Therefore, the maximum actual particulate emissions of 0.08 gr./dscf corrected to 7% O_2 generated from fuel oil combustion are less than the permit limit value of 0.1 gr./dscf. No ongoing compliance demonstration measures are required when firing fuel oil.

B. Conditions I.G.2 and II.G.2

For PM lb/day emissions from natural gas combustion alone:

Boiler No. 1 is limited to 229 lb/day of particulate emissions.

$$5\frac{lb}{MMcf}\times\frac{1\,MMcf}{1{,}035\,MMBtu}\times 4{,}718\frac{MMBtu}{day}=22.8\frac{lb}{day}$$

The maximum actual PM emissions of 22.8 lb/day are less than the permit limit of 229 lb/day. No ongoing compliance demonstration measures are required when firing natural gas.

For PM lb/day emissions from fuel oil and natural gas combustion:

DE 96-AQ-I078 limits PM emissions from the No. 1 Power Boiler to 229 pounds of PM per day. To show compliance with DE 96-AQ-I078, the permittee will evaluate the PM emissions from the boiler at least annually using actual fuel uses and emission factors from AP-42 manual. As an example of how the emission may be estimated, the following calculations may be used. Note that methods of estimation are not inclusive.

$$A\frac{lb\,PM}{day}=\left[B\frac{MMcf}{day}\times 5\frac{lb\,PM}{MMcf}\right]+\left[C\frac{Mgal}{day}\times\left[9.19(S)+3.22\right]\frac{lb\,PM}{Mgal}\right]$$

where:

A = annual average daily PM emission rate in pounds per day (compliance parameter)
B = annual average daily usage of natural gas in million cubic feet per day
C = annual average daily usage of fuel oil in thousand gallons per day

Emission factor of 5 pounds per million cubic of natural gas was taken from EPA's AP-42 (10/96), Table 1.4-2. Emission factor of 9.19(S) + 3.22 PM/1000 gallon taken from AP-42 (10/96), Table 1.3-1.

C. Conditions I.G.3 and II.G.3

For sulfur dioxide (SO_2) emissions from natural gas combustion:

- 0.6 lb SO_2/MMcf of natural gas. (Taken from Table 1.4-1of AP-42 (10/96) for natural gas combustion in a large industrial boiler.)

$$0.6\frac{lb\,SO_2}{MMcf}\times\frac{1\,MMcf}{1{,}035\,MMBtu}\times 4{,}718\frac{MMBtu}{day}=2.7\frac{lb\,SO_2}{day}$$

According to the calculations, the SO_2 emissions based on maximum fuel input of 4,718 MMBtu/day of natural gas are less than the permit limit of 3,025 lbs SO_2/day. Thus, no ongoing compliance demonstration measures are required when firing natural gas.

For SO_2 emissions in pounds per day from fuel oil and natural gas combustion:

DE 96-AQ-I078, limits SO_2 emissions from the No. 1 Power Boiler to 3,025 pounds per day of SO_2. To show compliance with DE 96-AQ-I078, the permittee will evaluate the SO_2 emissions from the boiler at least annually using actual fuel uses and emission factor from AP-42 manual. As an example of how the emission may be estimated, the following calculations may be used. Note that methods of estimation are not inclusive

$$A\frac{lb\,SO_2}{day}=\left[B\frac{MMcf}{day}\times 0.6\frac{lb\,SO_2}{MMcf}\right]+\left[C\frac{Mgal}{day}\times 157(S)\frac{lb\,SO_2}{Mgal}\right]$$

where:

B = annual average daily usage of natural gas in million cubic feet per day
C = annual average daily usage of fuel oil in thousand gallons per day
D = annual average daily SO_2 emission rate in pounds per day (compliance parameter)

S = annual average sulfur content of fuel oil

Emission factor of 0.6 pounds per million cubic of natural gas was taken from EPA's AP-42 (10-96), Table 1.4-1. Emission factor of 157(S) pounds per thousand gallons of fuel oil is from EPA' AP-42 (10/96, Table 1.3-1.)

D. Conditions I.G.4 and I.H.3

DE 96-AQ-I078 limits combined SO_2 emissions from the No. 1 and No. 2 Power Boiler to 8,750 pounds per day of SO_2 on a daily basis. For natural gas only combustion, under "C. Conditions I.G.3 and II.G.3," the maximum potential SO_2 emissions from the No. 1 Power Boiler firing natural gas are 2.7 lbs SO_2/day. A similar calculation is performed here for the No. 2 Power Boiler:

$$0.6\frac{lb\,SO_2}{MMcf}\times\frac{1\,MMcf}{1{,}035\,MMBtu}\times 4{,}404\frac{MMBtu}{day}=2.6\frac{lb\,SO_2}{day}$$

According to the calculations, the combined SO_2 emissions from the No. 1 and No. 2 Power Boilers are less than the permit limit of 8,750 lbs SO_2/day. Thus, no ongoing compliance demonstration measures are required when firing only natural gas in the No. 1 and No. 2 Power Boilers.

To show compliance with DE 96-AQ-I078, the permittee will, on a monthly* basis, evaluate the combined SO_2 emissions for each day of the previous month which fuel oil is fired in the No. 1 and/or No. 2 Power Boiler(s) from actual fuel uses. As an example of how the emission may be estimated using the actual fuel uses, the following calculations may be used. Note that methods of estimation are not inclusive

$$E_{D1}\frac{lb\,SO_2}{day}=\frac{FO_{M1}\frac{1000\,gal}{month}\times 157(S)\frac{lb\,SO_2}{1000\,gal}}{T_{M1}\frac{hrs}{month}}\times T_{D1}\frac{hrs}{day}$$

$$E_{D2}\frac{lb\,SO_2}{day}=\frac{FO_{M2}\frac{1000\,gal}{month}\times 157(S)\frac{lb\,SO_2}{1000\,gal}}{T_{M2}\frac{hrs}{month}}\times T_{D2}\frac{hrs}{day}$$

$$E_{DC}=E_{D1}+E_{D2}$$

where:

E_{D1}, E_{D2} = daily average SO_2 emission rate in pounds per day from the No. 1 Power Boiler or No. 2 Power Boiler, respectively

E_{DC} = the combined daily average SO_2 emission rate in pounds per day from the No. 1 Power Boiler and No. 2 Power Boiler

FO_{M1}, FO_{M2} = total fuel oil fired from the previous month in the No. 1 Power Boiler or No. 2 Power Boiler, respectively

S = average sulfur content of fuel oil in the previous month

T_{M1}, T_{M2} = total hours in the previous month that fuel oil was fired in the No. 1 Power Boiler or No. 2 Power Boiler, respectively

T_{D1}, T_{D2} = total hours in a particular day of the previous month that fuel oil was fired in the No. 1 Power Boiler or No. 2 Power Boiler, respectively

For example, if:

- the No. 1 Power Boiler fired 40,000 gallons of fuel oil for a total of 200 hours in the previous month,
- the No. 2 Power Boiler fired 25,000 gallons of fuel oil for a total of 175 hours in the previous month,
- and the sulfur content of the fuel oil is 2% Sulfur,

The combined daily emission rate for a day in the previous month where the No. 1 Power Boiler fired fuel oil for 12 hours and the No. 2 Power Boiler fired fuel oil for 6 hours is calculated as follows:

$$E_{D1} = \frac{40\frac{1000\ gal}{month} \times 157(2)\frac{lb\ SO_2}{1000\ gal}}{200\frac{hrs}{month}} \times 12\frac{hrs}{day} = 754\frac{lb\ SO_2}{day}$$

$$E_{D2} = \frac{25\frac{1000\ gal}{month} \times 157(2)\frac{lb\ SO_2}{1000\ gal}}{175\frac{hrs}{month}} \times 6\frac{hrs}{day} = 269\frac{lb\ SO_2}{day}$$

$$E_{DC} = 754\frac{lb\ SO_2}{day} + 269\frac{lb\ SO_2}{day} = 1{,}023\frac{lb\ SO_2}{day}$$

E. Conditions I.G.5 and I.H.4

DE 96-AQ-I078 limits combined SO_2 emissions from the No. 1 and No. 2 Power Boiler to 1,104 tons per year of SO_2 on an annual average basis. For natural gas only combustion, under "C. Conditions I.G.3 and II.G.3," the maximum potential SO_2 emissions from the No. 1 Power Boiler firing natural gas are 2.7 lbs SO_2/day. Similarly, under D. Conditions I.G.5 and II.H. 3" the maximum potential SO_2 emissions from the No. 2 Power Boiler firing natural gas are 2.6 lbs SO_2/day for natural gas only combustion. Thus, the combined annual average maximum potential SO_2 emissions from the No. 1 and No. 2 Power Boilers are 0.97 tons/year (2.6 lbs/day + 2.7 lbs/day at 365 days/year and 2000 lbs/ton). Thus, no ongoing compliance demonstration measures are required when firing only natural gas in the No. 1 and No. 2 Power Boilers.

To show compliance with DE 96-AQ-I078, the permittee will, on a monthly* basis, evaluate the combined annual average SO_2 emissions from the No. 1 and No. 2 Power Boilers by calculating the sum of the previous 12 months' SO_2 emissions. SO_2 emissions will only be calculated for those months during which fuel oil was combusted in either the No. 1 and/or No. 2 Power Boilers. As an example of how the emission may be estimated, the following calculations may be used. Note that methods of estimation are not inclusive

$$E_{MC}\frac{ton\ SO_2}{month}=\left(FO_{M1}\frac{1000\ gal}{month}+FO_{M2}\frac{1000\ gal}{month}\right)\times 157(S)\frac{lb\ SO_2}{1000\ gal}\times\frac{1\ ton}{2{,}000\ lbs}$$

$$E_A\frac{ton\ SO_2}{year}=\sum_{\text{12 Months Previous}}E_{MC}\frac{ton\ SO_2}{month}$$

where:

E_{MC} = combined monthly* average SO_2 emission rate in tons per month from the No. 1 Power Boiler and No. 2 Power Boiler

E_A = annual average SO_2 emission rate in tons per month from the No. 1 Power Boiler and No. 2 Power Boiler

FO_{M1}, FO_{M2} = total fuel oil fired from the previous month in the No. 1 Power Boiler or No. 2 Power Boiler, respectively

S = average sulfur content of fuel oil in the previous month

F. Conditions I.G.4 and II.G.4

Conditions I.G.4 and II.G.4 are state-only requirements and are not federally enforceable under the federal Clean Air Act, per DE 95AQ1055 as consolidated in DE 96-AQ1078.

VIII. KAMYR Digester and No. 3 Evaporator Set

A. Conditions I.J.1 and I.J.2

The KAMYR Digester and No. 3 Evaporator set are subject to the TRS requirements of 40 CFR 60.283(a)(1). The rule specifies that gases from these units containing TRS in excess of 5 ppmvd, corrected to 10 percent oxygen, shall meet the conditions of 40 CFR 60.283(a)(1)(i-vi).

Gases from the KAMYR Chip Steaming Vessel do not contain TRS, and therefore do not require control. Gases from the KAMYR Digester, the KAMYR Blow Tank, and the No. 3 Evaporator Set are routed to the KAMYR Condenser. Gases that are not condensed in the KAMYR Condenser are routed to the NCG collection system, which delivers the gases to the Lime Kiln and/or Hog Fuel Boiler for combustion. The temperature and residence time requirements (1200 °F for 0.5 seconds) of 40 CFR 60.283(a)(1)(iii) were considered in the design of

the NCG collection system, and are met in the design of the Lime Kiln and Hog Fuel Boiler.

IX. Cyclone Box Clipping Collection System

Condition I.L.1 and II.L.1

The emission unit would have been categorized as an insignificant emission unit as defined under WAC 173-401-530(4). However, the unit is operated under an regulatory order. Therefore, it is an applicable requirement under the State Implementation Plan (SIP). [WAC 173-401-530(2)(c)]. The cyclone is a part of the paper clipping process ant not a control device. The particulate emissions from the filter bag represent less than one pound per day or 0.18 ton per year on an annual average. Ecology requires the permittee provide an inspection program to ensure compliance with the limitation for the cyclone. Inspection log will be maintained and made available for review by Ecology. Ecology determines that the emission unit is insignificant compared to other larger units that are required much more effort for monitoring evaluation and compliance. Thus, Ecology believes that quarterly inspection imposed on the cyclone is adequate. In addition, when the particulate filter system malfunctions, the permittee will take a corrective action within 24 hours. The permittee will also report excursions and corrective action in the monthly report.

Comments on General Conditions

I. General Condition 8

Permit condition 8 is the generic opacity limitation from WAC 173-405-040(6), which addresses kraft mills. Permit conditions 9 and 12 work together to assure compliance with Condition 8 by requiring, first, that facility equipment be maintained and operated "in a manner consistent with good air pollution control practice" and, second, that the permittee record and promptly respond to complaints received or possible noncompliance noticed by facility staff. Ecology believes that this is a practical and effective way to assure compliance because the emission units covered by this condition do not have control devices that can be monitored and they have a very low risk of producing visible emissions except during process upsets. The mill is staffed around the clock and all staff are trained to notice and report unusual conditions, such as those associated with upsets. It is a violation of the permit to fail to take corrective action when an instance of possible noncompliance has been reported and found to be valid. Ecology believes that imposing additional monitoring such as a weekly visual inspection would have little value in identifying noncompliance and would, by presence, possibly convey a false sense of compliance.

II. General Condition 10

All fuel combustion units assure compliance when firing natural gas and fuel oil based on the following calculations:

a. Sulfur Content Limit When Firing Fuel Oil

F_d = 9,190 dscf/MMBtu for residual oil. ("F" factor from 40 CFR, Part 60, App. A, Method 19)

$$C_d = \frac{(0.02\,lb\,S / lb\,oil)(2\,lb\,SO_2 / lb\,S)(385\,dscf\,SO_2 / 64\,lb\,SO_2)}{(18{,}750\,Btu / lb\,oil)(9{,}190\,dscf\ /\ MMBtu)}$$

or,

$$C_d = 0.00140\frac{dscf\,SO_2}{dscf\ flue\,gas} = 1{,}400\,ppmvd\,SO_2$$

Corrected to 7% O2:

$$(1{,}400\,ppmvd\,SO_2) \times \frac{20.9 - 7.0}{20.9} = 930\,ppmvd\,SO_2\,at\,7\%\,O_2$$

Therefore, the sulfur content limit of 2% in the fuel oil assures compliance with 1000 ppmvd corrected to 7% O_2 as required by WAC 173-405-040(11)(b). No ongoing compliance demonstration measures are required.

b. Sulfur Content Limit When Firing Natural Gas

- 0.6 lb/MMcf of natural gas. (Taken from Table 1.4-1, 1.4-2, & 1.4-3 of AP-42, for natural gas combustion in a large industrial boiler.)
- $pV = mRT$

where,

p = 14.7 psia (2166.8 lbf/ft^2)
R = 24.1 ft-lbf/lbm-°R
m = 64 lbm
T = 538°R

then, V = 385

Sulfur dioxide emissions in parts per million:

$$0.6\frac{lb\,SO_2}{MMcf} \times \frac{1\,MMcf}{1{,}035\,MMBtu} \times \frac{1\,MMBtu}{8710\,dscf} \times \frac{385\,dscf\,SO_2}{64\,lb\,SO_2} = 4 \times 10^{-7}\,\frac{dscf\,SO_2}{dscf\ flue\,gas}$$

=0.4 ppmv SO_2

According to the calculations, the sulfur dioxide emissions are less than the limit of 1000 ppmvd. No ongoing compliance demonstration measures are required.

For sources other than fuel combustion, Ecology has not imposed monitoring for units unlikely to have a reasonable potential of exceeding SO_2 emission limits. Surrogate monitoring for intervals between direct SO_2 testing was not imposed because in practice mills do not adjust operating parameters to minimize SO_2 emissions. There are no control devices or control strategies to allow this. Instead, SO_2 emissions are largely a function of equipment and process design. The nature of the kraft process is optimized by system stability and continuity. Ecology has no basis to believe that process parameters fluctuate to a degree that results in SO_2 emissions approaching the 1000 ppm limit and thus warranting surrogate monitoring.

III. Insignificant Emission Units

The facility-wide general requirements apply to the whole facility, including insignificant emission units and activities (IEUs), as required by the operating permit rule. The rule states, however, that IEUs are not subject to monitoring requirements unless the generally applicable requirements in the State Implementation Plan (SIP) impose them. [WAC 173-401-530(2)(c)]. The Washington SIP does not impose any specific monitoring-related requirements for the facility-wide requirements for IEUs at this source. The permit, therefore, does not require any testing, monitoring, reporting, or recordkeeping for insignificant emission units or activities.

IV. Regulatory Orders and Permits

The permittee is subject to two PSD permits and a regulatory order. The first PSD permit, Permit No. PSD-X-77-04 issued by the EPA Region X in February 1978. This permit imposes limits for particulate matter, opacity, and sulfur dioxide to limited emission units, including the No. 2 recovery furnace and No. 2 dissolver vent, the lime kiln, the decker hood, the hog fuel boiler, and the No.1 power boiler. The second PSD permit, Permit No. PSD-95-04 issued by the Air Programs, Washington State Department of Ecology in September 1995 in accordance with WAC 173-400-141. This permit imposes limits for two different alternate operating scenarios: 1) Scenario 1 consists of installing and additional M&D digester and adding tri-level air to an existing recovery furnace. The additional digester will increase the capacity to meet future market demands. The addition of tri-level air to the No. 3 recovery furnace will increase the chemical recovery and decrease total reduced sulfur compound emissions. The new digester will require steam to provide energy for the pulping process. This steam will be obtained from the modified No. 3 Recovery Furnace. 2) Scenario 2 consists of installing only the additional M&D digester. Steam that required for the pulping process in the digester will be obtained by increasing the utilization of the power boiler No. 1 and 2 up to their permitted capacities.

Order DE 96-AQ-I078 consolidates all previous requirements from past state approvals, orders and letters, which were issued by the state.

Appendix A. Applicable Requirements Consolidated to Single Permit Terms

Certain permit conditions impose a single emission limit or requirement that is based on two or more underlying applicable requirements. This table presents the basis for consolidating these redundant requirements into single permit conditions.

A. No. 2 Recovery Furnace

Limit #	Underlying Applicable Requirements -- Cite and Paraphrase of Requirement	Basis for Consolidating
I.A.1 & II.A.1	**Order DE 96-AQ-I078**: particulate limit of 0.044 gr./dscf @ 8% O2 on an hourly average. **WAC 173-405-040(1)(a)**: particulate emissions shall not exceed 0.1 gr./dscf @ 8% O2 averaged over three one-hour tests.	The permit uses the order limit because it is more stringent than the WAC limit.

B. No. 3 Recovery Furnace

Limit #	Underlying Applicable Requirements -- Cite and Paraphrase of Requirement	Basis for Consolidating
II.B.1	**Order DE 96-AQ-I078**: particulate limits of 0.027 gr./dscf @ 8% O2 averaged over three one-hour tests. **WAC 173-405-040(1)(a)**: particulate emissions shall not exceed 0.1 gr./dscf @ 8% O2 averaged over three one-hour tests.	The permit uses the order limit because it is more stringent than the WAC limit.
II.B.3	**Order DE 96-AQ-I078**: opacity limit of 20% for 6 consecutive minutes in any 60-minute period when firing fuel oil. **WAC 173-405-040(6)**: no plume from a recovery furnace with an average opacity greater than 35% for more than 6 consecutive minutes in any 60-minute period.	The permit uses the order limit because it is more stringent than the WAC limit.
II.B.13	**Order DE 96-AQ-I078**: TRS limit of 5 ppmvd @ 8% O2 averaged on a 12-hour basis. **WAC 173-405-040(1)(c)**: TRS emissions shall not exceed 5 ppm @ 8% O2 on a daily averages; DOE Method 12.	The permit uses the order limit because it is more stringent than the WAC limit.

C. Lime Kiln

Limit #	Underlying Applicable Requirements -- Cite and Paraphrase of Requirement	Basis for Consolidating
I.C.1 & II.C.1	**Order DE 96-AQ-I078**: particulate limits of 0.12 gr./dscf @ 10% O2 when firing fuel oil and 0.067 gr./dscf @ 10% O2 when firing natural gas; hourly average. **WAC 173-405-040(3)(a)**: particulate emissions shall not exceed 0.13 gr./dscf @ 10% O2. **40 CFR 60.282(a)(3)(ii)**: particulate emissions shall not exceed 0.13 gr./dscf @ 10% O2 when firing fuel oil.	The permit uses the order limit because it is more stringent than the WAC and NSPS limits.

I.C.7 & II.C.7	**Order DE 96-AQ-I078and 40 CFR 60.283(a)(5)**: TRS limit of 8 ppmvd @ 10% O2 averaged on a 12-hour basis. **WAC 173-405-040(3)(c)**: TRS emissions shall not exceed 20 ppmvd @ 10% O2 on a daily average.	The permit uses the order/NSPS limit because it is more stringent than the WAC limit.

D. No. 2 Smelt Dissolver Tank

Limit #	Underlying Applicable Requirements -- Cite and Paraphrase of Requirement	Basis for Consolidating
I.D.1 & II.D.1	**Order DE 96-AQ-I078and 40 CFR 60.282(a)(2)**: particulate limit of 0.2 lb particulate per ton of black liquor solids averaged hourly. **WAC 173-405-040(2)**: particulate emissions from smelt dissolver tank vents shall not exceed 0.30 lb per ton of solids fired at associated recovery furnace.	The permit uses the order/NSPS limit because it is more stringent than the WAC limit.

E. Hog Fuel Boiler

Limit #	Underlying Applicable Requirements -- Cite and Paraphrase of Requirement	Basis for Consolidating
I.F.1 & II.F.1	**Order DE 96-AQ-I078**: particulate limit of 0.04 gr./dscf @ 12% CO2 averaged over three 1-hour tests. **WAC 173-405-040(5)(a)**: particulate emissions shall not exceed 0.2 gr./dscf @ 7% O2.	The permit uses the order limit because it is more stringent than the WAC limit.

APPENDIX B. Historical Emission Testing Results

BOISE CASCADE WALLULA MILL
PARTICULATE TEST RESULTS FOR MAJOR EMISSIONS UNITS

Source	Month	Particulate -- gr./DSCF				
		1993	1994	1995	1996	1997
No. 2 Recovery Furnace	1	0.002	0.010	0.037	0.004	0.014
	2	0.002	0.012	0.036	0.010	0.015
	3	0.007	0.013	0.036	0.011	0.014
	4	0.008	0.017	0.007	Mill Down	0.011
	5	0.003	0.006	0.008	0.033	[a]
	6	0.003	0.025	0.039	0.012	[a]
	7	0.027	0.008	0.019	0.012	0.018
	8	0.002	0.005	0.020	0.015	[a]
	9	0.006	0.003	0.048	0.031	[a]
	10	Mill Down	0.025	0.006	0.027	0.014
	11	0.015	0.026	0.005	0.026	[a]
	12	0.012	0.030	0.007	0.027	[a]
		Permit Limit: 0.044 gr./DSCF				

Source	Month	Particulate -- gr./DSCF				
		1993	1994	1995	1996	1997
No. 3 Recovery Furnace	1	0.013	0.007	0.007	0.006	0.004
	2	0.019	0.020	0.015	0.005	0.005
	3	0.014	0.023	0.009	0.009	0.005
	4	0.021	0.011	0.009	Mill Down	0.011
	5	0.009	0.009	0.008	0.006	0.013
	6	0.011	0.011	0.008	0.014	[a]
	7	0.012	0.014	0.007	0.015	0.003
	8	0.014	0.007	0.007	0.015	[a]
	9	0.013	0.004	0.006	0.011	[a]
	10	Mill Down	0.008	0.012	0.006	0.004
	11	0.013	0.007	0.005	0.005	[a]
	12	0.019	0.008	0.010	0.005	[a]
		Permit Limit: 0.1 gr./DSCF				

BOISE CASCADE WALLULA MILL
PARTICULATE TEST RESULTS FOR MAJOR EMISSIONS UNITS

Source	Month	Particulate -- gr./DSCF				
		1993	1994	1995	1996	1997
No. 2 Dissolver Tank Vent	1	0.071	0.119	0.155	0.040	(a)
	2	0.094	0.136	0.166	0.016	0.100
	3	0.120	0.186	0.187	0.110	(a)
	4	0.154	0.118	0.120	Mill Down	(a)
	5	0.105	0.139	0.200	0.060	0.090
	6	0.124	0.150	0.100	0.100	(a)
	7	0.081	0.136	0.100	0.080	0.190
	8	0.076	0.106	0.200	0.050	0.150
	9	0.085	0.080	0.031	0.090	0.190
	10	Mill Down	0.098	0.019	0.080	0.160
	11	0.102	0.069	0.030	0.110	0.120
	12	0.120	0.152	0.030	(a)	0.110
		Permit Limit: 0.2 lbs/ton Black Liquor Solids (BLS) Fired				

Source	Month	Particulate -- gr./DSCF				
		1993	1994	1995	1996	1997
No. 3 Dissolver Tank Vent	1	0.070	0.140	0.155	0.030	0.150
	2	0.090	0.120	0.040	0.060	0.110
	3	0.220	0.120	0.050	0.090	0.110
	4	0.120	0.130	0.100	Mill Down	(a)
	5	0.130	0.130	0.200	0.070	0.140
	6	0.020	0.160	0.100	0.200	(a)
	7	0.100	0.200	0.200	0.260	0.190
	8	0.140	0.110	0.200	0.120	(a)
	9	0.130	0.150	0.100	0.110	(a)
	10	Mill Down	0.050	0.100	0.120	0.190
	11	0.060	0.050	0.090	0.080	(a)
	12	0.101	0.060	0.090	0.100	(a)
		Permit Limit: 0.3 lbs/ton Black Liquor Solids (BLS) Fired				

PARTICULATE TEST RESULTS FOR MAJOR EMISSIONS UNITS

Source	Month	Particulate -- gr./DSCF				
		1993	1994	1995	1996	1997
Lime Kiln	1	0.063	0.210	0.110	0.026	0.035
	2	0.048	0.023	0.028	0.021	0.024
	3	0.054	0.035	0.027	0.030	0.032
	4	0.048	0.050	0.028	Mill Down	0.045
	5	0.045	0.039	0.038	0.036	0.041
	6	0.052	0.052	0.050	0.037	(a)
	7	0.037	0.042	0.031	0.030	0.016
	8	0.034	0.040	0.029	0.047	(a)
	9	0.061	0.055	0.026	0.060	(a)
	10	Mill Down	0.052	0.056	0.033	0.038
	11	0.066	0.062	0.032	0.052	(a)
	12	0.052	0.056	0.025	0.046	(a)
		Permit Limit: 0.067 gr./DSCF (Gas), 0.12 gr./DSCF (Oil)				

Source	Month	Particulate -- gr./DSCF				
		1993	1994	1995	1996	1997
Hog Fuel Boiler	1	0.030	0.040	0.040	0.020	.0030
	2	0.030	0.040	0.030	0.020	0.030
	3	0.030	0.040	0.040	0.020	0.033
	4	0.040	0.040	**0.050**	Mill Down	0.030
	5	0.040	0.040	0.040	0.030	0.030
	6	0.040	0.040	0.040	0.030	0.040
	7	0.040	0.040	0.030	0.030	0.040
	8	0.040	0.040	0.027	0.020	0.040
	9	0.040	0.040	0.020	0.020	0.040
	10	0.040	0.040	Gas Fired	0.030	0.030
	11	0.030	0.040	0.020	0.030	0.040
	12	0.030	0.040	0.020	0.030	0.030
		Permit Limit: 0.04 gr./DSCF				

(a) Particulate emissions are less than 75% of the limit for six consecutive months. Test quarterly according to Regulatory Order No. DE 96-AQI078

APPENDIX C: Fulfilled One-Time Requirements

40 CFR 60.13(b) WAC 173-400-115 WAC 173-405-033	Monitoring devices must be installed and operational prior to conducting initial performance test.
40 CFR 60.13(c) WAC 173-400-115 WAC 173-405-033	Must perform initial performance evaluation using prescribed methods and report results to the Administrator.
40 CFR 60.13(c) WAC 173-400-115 WAC 173-405-033	Must perform initial performance evaluation using prescribed methods and report results to the Administrator.
40 CFR 60.285(a) WAC 173-400-115 WAC 173-405-033	Initial performance tests, as required by 40 CFR 60.8, must be performed using the test method in App. A of 40 CFR Pt. 60.
40 CFR 60.13(b) WAC 173-400-115 WAC 173-405-033	All CEMS and monitoring devices must be installed and operational prior to conducting initial performance test.
40 CFR 60.285(a) WAC 173-400-115 WAC 173-405-033	Initial performance tests, as required by 40 CFR 60.8, must be performed using the test method in App. A of 40 CFR Pt. 60.
40 CFR 60.13(c) WAC 173-400-115 WAC 173-405-033	Must perform initial performance evaluation using prescribed methods and report results to the Administrator.
40 CFR 60.11(e)(4)	Must record the COM data produced during the initial performance test and furnish to the Administrator a written report of the results along with the U.S. EPA Method 9 and performance test results

APPENDIX D
Monitoring Requirements

The table below illustrates whether or not the following units and pollutants are subject to periodic monitoring as prescribed in 40 CFR 70.6(a)(3). Each requiremment is identified by the alphanumeric nomenclature as found in the permit. (e.g. I.A.1 for opacity for the No. 2 Recovery Furnace.)

40 CFR 60

	Parameter	Applicable Requirement(s)	Subject to Periodic Monitoring	Justification
I.A.1	Particulate	40 CFR 60.282(a)(1)(i)	YES	40 CFR 60.282(a)(1)(i) does not have any periodic monitoring or testing requirements. Periodic monitoring under section 70.6(a)(3)(i)(B) is required if "the applicable requirement does not require periodic testing or instrumental or noninstrumental monitoring," thus periodic monitoring is required. Monthly source testing is required in Consolidated Order DE 96-AQI078, thus fulfilling the 70.6(a)(3)(i)(B) requirement.
I.A.3	Opacity	40 CFR 60.282(a)(1)(ii) 40 CFR 60.284(e)(1)(ii) WAC 173-405-040(6)	NO	The sections listed to the left are all regulated by 40 CFR 60.282 and 283. These sections contain emissions limits for opacity and TRS, respectively. 40 CFR 284 mandates continuous monitoring systems to monitor opacity levels and TRS emissions. Since periodic monitoring under section 70.6(a)(3)(i)(B) is only required if "the applicable requirement does not require periodic testing or instrumental or noninstrumental monitoring," no additional monitoring is applicable.
I.A.6	TRS	40 CFR 60.283(a)(2) 40 CFR 60.284(e)(1)(i)	NO	
I.C.7	TRS	40 CFR 60.283(a)(5)	NO	
I.D.1	Particulate	40 CFR 60.282(a)(2), WAC 173-405-040(2)	NO	The sections listed to the left are all regulated by 40 CFR 60.282 and 283. These sections contain emissions limits on black liquor solids. 40 CFR 284 mandates continuous monitoring systems to monitor pressure loss and scrubber pressure. Since periodic monitoring under section 70.6(a)(3)(i)(B) is only required if "the applicable requirement does not require periodic testing or instrumental or noninstrumental monitoring," no additional monitoring is applicable.
I.D.4	TRS	40 CFR 60.283(a)(4)	NO	

WAC 173-405-040

	Parameter	Subject to Periodic Monitoring	Justification
I.A.4	SO_2	NO	The sections listed to the left are all regulated by sub-sections of WAC 173-405-040. Each of these sub-sections requires some form of emissions limit. In this same section, WAC 173-405-040(12) states that "To demonstrate compliance with this chapter, the provisions of WAC 173-400-105 shall apply to all sources to which this chapter is applicable." WAC 173-400-105 requires that the source "...upon notification by the director of ecology, maintain records on the type and quantity of emissions from the source and other information deemed necessary to determine whether the source is in compliance with the applicable emissions limitations and control measures." Ecology, in Consolidated Order No. DE 96-AQI078, mandates periodic source testing. The underlying requirement already contains periodic source testing requirements in WAC 405 and 400, as carried out in the Consolidated Order. Since periodic monitoring under section 70.6(a)(3)(i)(B) is only required if "the applicable requirement does not require periodic testing or instrumental or noninstrumental monitoring," no additional monitoring is applicable.
I.B.1	Particulate	NO	
I.B.2	Opacity	NO	
I.B.3	SO_2	NO	
I.C.3	Opacity	NO	
I.C.4	SO_2	NO	
I.D.3	Opacity	NO	
I.E.1	Particulate	NO	
I.E.2	Opacity	NO	
I.F.3	Opacity	NO	
I.G.1	Particulate	NO	
I.H.1	Particulate	NO	

Consolidated Order DE 96-AQI078

	Parameter	Subject to Periodic Monitoring	Justification
I.A.2	Particulate	NO	The sections listed to the left are all regulated by Consolidated Order DE 96-AQI078. Each of these sections requires some form of emissions limit. Ecology, in Consolidated Order No. DE 96-AQI078, mandates periodic source testing. Since periodic monitoring under section 70.6(a)(3)(i)(B) is only required if "the applicable requirement does not require periodic testing or instrumental or noninstrumental monitoring," no additional monitoring is applicable.
I.A.5	SO_2	NO	
I.C.1	Particulate	NO	
I.C.2		NO	
I.C.5	SO_2	NO	
I.C.6		NO	
I.D.2	Particulate	NO	
I.F.1	Particulate	NO	
I.F.2		NO	
I.G.2	Particulate	NO	
I.G.3	SO_2	NO	

Non-Applicable

	Parameter	Applicable Requirement(s)	Subject to Periodic Monitoring	Justification
I.A.7	Operation	WAC 173-405-040(10)	N/A	The sections listed to the left are operational in nature and do not require monitoring.
I.B.4	Operation	WAC 173-405-040(10)	N/A	
I.C.8	Operation	WAC 173-405-040(10)	N/A	
I.D.5	Operation	WAC 173-405-040(10)	N/A	
I.D.6	Damper position	DE 78-112 as consolidated in Order DE 96-AQI078	N/A	
I.E.3	Operation	WAC 173-405-040(10)	N/A	
I.E.4	Damper position	DE 78-112 as consolidated in Order DE 96-AQI078	N/A	
I.F.4	Operation	WAC 173-405-040(10)	N/A	
I.G.6	Operation	Order DE 96-AQI078	N/A	
I.H.4	Operation	Order DE 96-AQI078	N/A	
I.B.5	TRS	WAC 173-405-040(1)(c)	N/A	State Only Requirement
I.C.9	TRS	WAC 173-405-040(3)(b)	N/A	
I.G.4 I.G.5	SO_2	As consolidated in Order DE 96-AQI078.	N/A	
I.H.2 I.H.3	SO_2	As consolidated in Order DE 96-AQI078.		

APPENDIX E
Opacity and Grain Loading Data

Testing conducted to evaluate opacity versus grain loading for the No. 2 and No.3 Recovery Furnaces. The data support the use of opacity as a good general indicator of control device performance but is not significant enough to make direct linear correlation. Air pollution control equipment should be promptly examined to ensure proper operation when the continuous opacity monitoring device reads high opacity.

	#2 Recovery Boiler			#3 Recovery Boiler	
	OPACITY %	PATICULATES GR./DSCF		OPACITY %	PARTICULATES GR./DSCF
1/11/93	4.0	0.002	1/26/93	11.2	0.009
1/7/93	3.3	0.002	1/15/93	29.7	0.013
1/6/93	3.4	0.002	1/15/93	23.7	0.016
2/17/93	3.7	0.002	2/26/93	16.1	0.021
2/16/93	4.3	0.002	2/26/93	28.4	0.024
2/15/93	4.2	0.002	2/22/93	10.0	0.012
3/24/93	5.1	0.004	3/26/93	12.3	0.016
3/23/93	5.5	0.004	3/25/93	16.5	0.010
3/23/93	5.1	0.011	3/25/93	10.5	0.015
4/16/93	6.7	0.006	4/22/93	24.9	0.034
4/15/93	9.1	0.011	4/21/93	14.4	0.014
4/15/93	6.9	0.006	4/13/93	11.6	0.015
5/20/93	3.7	0.003	5/13/93	7.1	0.007
5/20/93	4.3	0.002	5/13/93	6.3	0.009
5/19/93	4.6	0.003	5/12/93	8.2	0.010
6/15/93	5.1	0.003	6/11/93	10.7	0.012
6/15/93	5.2	0.004	6/10/93	10.6	0.011
6/14/93	4.3	0.002	6/9/93	11.5	0.010
7/28/93	15.3	0.030	7/22/93	15.2	0.013
7/27/93	10.9	0.030	7/20/93	6.2	0.012
7/23/93	11.5	0.021	7/20/93	6.6	0.011
8/25/93	4.8	0.003	8/27/93	9.5	0.014
8/25/93	4.8	0.002	8/26/93	9.9	0.012
8/24/93	4.9	0.002	8/26/93	11.9	0.015
9/10/93	5.8	0.006	9/18/93	2.3	0.013
9/10/93	5.8	0.006	9/18/93		0.013
9/10/93	8.3	0.006	9/11/93	2.3	0.012
11/16/93	7.0	0.014	11/24/93	4.3	0.004
11/15/93	10.4	0.014	11/23/93	9.8	0.015
11/15/93	8.0	0.016	11/23/93	7.7	0.018
12/16/93	9.1	0.013	12/13/93	8.0	0.014
12/14/93	10.6	0.012	12/13/93	7.8	0.013
12/14/93	8.2	0.010	12/9/93	7.2	0.030
3/7/94	11.8	0.009	3/9/94	11.7	0.027
3/4/94	14.4	0.015	3/8/94	7.2	0.019
3/3/94	14.7	0.014	3/8/94	11.5	0.024
4/15/94	11.8	0.025	4/20/94	3.8	0.007
4/15/94	9.4	0.015	4/20/94	2.9	0.007
4/14/94	10.5	0.009	4/19/94	4.0	0.019
5/11/94	8.9	0.005	5/20/94	7.9	0.007
5/11/94	9.4	0.005	5/18/94	6.0	0.010
5/10/94	8.9	0.006	5/18/94	5.0	0.009

6/17/94	6.3	0.006	6/21/94	11.0	0.012
6/16/94	12.8	0.022	6/21/94	9.4	0.010
6/15/94	23.5	0.048	6/20/94	8.3	0.012
7/14/94	4.4	0.006	7/12/94	8.5	0.018
7/13/94	4.6	0.009	7/12/94	7.3	0.012
7/13/94	2.4	0.009	7/11/94	14.0	0.013
8/5/94	4.1	0.005	8/6/94	4.7	0.007
8/5/94	4.1	0.005	8/6/94	8.5	0.007
8/5/94	2.9	0.005	8/5/94	4.5	0.006
9/16/94	3.1	0.003	9/20/94	3.4	0.003
9/15/94	5.1	0.003	9/19/94	2.9	0.005
9/15/94	3.6	0.004	9/19/94	3.5	0.005
10/24/94	13.3	0.018	10/20/94	7.3	0.009
10/24/94	7.4	0.022	10/20/94	13.7	0.009
10/21/94	26.0	0.036	10/19/94	6.8	0.006
11/3/94	12.4	0.025	11/7/94	5.4	0.004
11/2/94	19.4	0.025	11/4/94	9.1	0.007
11/1/94	7.0	0.027	11/4/94	7.9	0.010
12/19/94	13.7	0.029	12/15/94	10.4	0.008
12/16/94	19.1	0.035	12/14/94	7.7	0.008
12/16/94	13.2	0.025	12/13/94	6.8	0.009
2/17/94	9.6	0.013	2/21/94	21.7	0.022
2/16/94	9.7	0.012	2/21/94	16.9	0.022
2/16/94	10.8	0.012	2/18/94	12.6	0.016
1/17/94	5.8	0.010	1/27/94	8.1	0.007
1/13/94	5.3	0.010	1/26/94	4.0	0.005
1/13/94	5.9	0.009	1/26/94	4.6	0.007
1/10/95	21.8	0.035	1/26/95	10.8	0.008
1/10/95	20.5	0.034	1/26/95	9.3	0.007
1/9/95	22.0	0.041	1/26/95	7.9	0.006
2/14/95	18.5	0.033	2/8/95	6.7	0.009
2/14/95	18.6	0.040	2/7/95	16.2	0.023
2/13/95	23.0	0.036	2/6/95	9.4	0.016
3/10/95	16.2	0.016	3/16/95	7.4	0.008
3/7/95	26.2	0.047	3/15/95	7.8	0.007
3/7/95	28.5	0.044	3/15/95	9.1	0.013
4/21/95	7.2	0.005	4/20/95	8.2	0.009
4/21/95	7.2	0.007	4/19/95	8.3	0.008
4/20/95	6.7	0.007	4/19/95	9.6	0.010
5/9/95	8.8	0.007	5/5/95	9.9	0.008
5/9/95	7.5	0.008	5/2/95	8.5	0.007
5/9/95	7.1	0.009	5/2/95	8.5	0.008
6/20/95	14.4	0.032	6/9/95	11.7	0.006
6/16/95	20.4	0.043	6/8/95	8.0	0.009
6/13/95	26.0	0.036	6/7/95	10.0	0.007
7/27/95	15.8	0.019	7/20/95	10.4	0.009
7/25/95	11.1	0.020	7/19/95	9.0	0.007
7/25/95	16.0	0.018	7/18/95	9.7	0.006
8/16/95	11.8	0.013	8/2/95	12.2	0.006

8/4/95	10.7	0.025	8/2/95	8.6	0.008
8/4/95	10.7	0.022	8/1/95	7.3	0.007
9/22/95	25.2	0.057	9/28/95	10.2	0.006
9/20/95	26.0	0.044	9/28/95	6.8	0.006
9/20/95	26.4	0.042	9/28/95	9.6	0.006
10/30/95	4.5	0.005	10/24/95	7.0	0.012
10/30/95	3.9	0.005	10/23/95	7.0	0.011
10/27/95	10.7	0.015	10/20/95	8.2	0.013
11/11/95	3.5	0.005	11/10/95	9.9	0.006
11/11/95	4.4	0.004	11/10/95	3.4	0.006
11/11/95	4.4	0.005	11/10/95	4.1	0.005
12/20/95	6.0	0.009	12/19/95	19.0	0.015
12/20/95	6.0	0.006	12/19/95	16.5	0.013
12/20/95	6.0	0.007	12/19/95	16.5	0.010
1/18/96	4.3	0.003	1/30/96	5.0	0.005
1/18/96	4.2	0.004	1/30/96	4.8	0.006
1/17/96	3.4	0.004	1/29/96	5.1	0.005
2/9/96	4.0	0.005	2/21/96	4.8	0.005
2/8/96	6.7	0.016	2/21/96	5.2	0.005
2/8/96	6.7	0.008	2/9/96	4.8	0.004
3/18/96	13.1	0.018	3/22/96	15.3	0.008
3/15/96	5.8	0.008	3/19/96	15.3	0.009
3/14/96	5.8	0.007	3/19/96	15.3	0.010
5/22/96	10.0	0.017	5/15/96	4.3	0.005
5/22/96	7.4	0.019	5/15/96	10.9	0.006
5/16/96	14.9	0.063	5/14/96	7.1	0.008
6/19/96	8.8	0.011	6/14/96	6.2	0.015
6/18/96	5.9	0.012	6/13/96	15.5	0.015
6/18/96	9.3	0.013	6/13/96	12.3	0.014
7/16/09	3.3	0.008	7/23/96	16.0	0.019
7/16/96	3.9	0.009	7/22/96	10.6	0.013
7/15/96	4.9	0.018	7/22/96	10.6	0.013
8/15/96	7.6	0.015	8/13/96	10.4	0.008
8/15/96	7.0	0.014	8/12/96	16.0	0.013
8/13/96	11.0	0.015	8/12/96	16.0	0.023
9/16/96	14.7	0.027	9/30/96	15.0	0.013
9/13/96	10.2	0.026	9/30/96	15.1	0.010
9/13/96	14.4	0.041	9/30/97	6.3	0.010
10/10/96	13.0	0.025	10/17/96	5.0	0.008
10/8/96	13.0	0.027	10/16/96	3.9	0.005
10/8/96	13.0	0.030	10/15/96	6.1	0.006
12/11/96	19.9	0.028	11/22/96	8.2	0.005
12/13/96	12.6	0.028	12/16/97	7.5	0.004
1/17/97	7.7	0.014	1/17/97	8.3	0.004
2/12/97	9.5	0.016	2/7/97	8.4	0.007
3/17/97	6.5	0.013	3/17/97	7.5	0.005
4/29/97	6.5	0.011	4/23/97	8.7	0.011
7/16/97	10.1	0.018	5/7/97	21.0	0.014
10/6/97	7.5	0.014	7/22/97	3.3	0.003

1/19/98	7.1	0.014	10/7/97	2.6	0.004
5/7/98	7.8	0.015	1/26/98	2.6	0.003
7/7/98	20.2	0.035	5/11/98	3.0	0.002
8/31/98	16.3	0.040	7/21/98	2.9	0.004
9/17/98	15.3	0.037			